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[OFFICIAL NOTICE.]

Thirteenth Annual Meeting, Ohio Gas Light Association.

THE OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
COLUMBUS, O., Jan. 4, 1897.

The thirteenth annual meeting of the Ohio Gas Light Association will be held in New York city, Wednesday and Thursday, February 3 and 4, 1897, in one of the parlors of Madison Square Garden.

Papers will be read by—

Mr. E. S. Templeton, Secretary and Treasurer Ashtabula (O.) Gas Company, on "Advertising."

Mr. T. C. Jones, Superintendent Gas Company, Delaware, O., on "Gas Stoves: Their Introduction, Construction and Use."

Mr. Irvin Butterworth, General Manager Gas Company, Columbus, O., on "A Curious Gas Explosion."

Mr. E. T. Lloyd, Secretary Western Gas Construction Company, Fort Wayne, Ind., on "The Large Gas Engine: Its Present Developments and Forecast of its Future for Electrical Purposes."

Mr. G. H. Christian, Superintendent Norwalk Gas Company, Norwalk, O., on "State Regulation of Corporations."

Mr. J. F. Seamon, Superintendent United Light Company, Uniontown, Pa., on "Some Facts Relating to Gas and Electricity."

The Question Box will be given more than its usual attention, and every member is earnestly requested to contribute to it.

One of the features of our meeting last year was the Executive Session, held on the morning of the second day. It afforded an opportunity for a freer exchange of ideas than is given in the regular sessions, and the Executive Committee have deemed it advisable to hold a similar meeting this year, on the morning of February 4.

Efforts have been made to get reduced railroad rates, but so far without success, excepting by the use of "party" ticket. In order to avail ourselves of these tickets it will be necessary for at least 10 to travel on one solid ticket on same train.

On account of its central location, as regards our membership, the Executive Committee thought it would be pleasant for as many as possible to meet at Columbus and leave there on the evening train, February 1, reaching New York city the next afternoon. Provided a sufficient number will arrange to go in this way, special sleeping cars can be secured for the exclusive use of our party. The rate of fare from Columbus to New York city, conditioned upon the use of this ticket, is $12.75, and charge for sleeping car berths is $3.50. Those who do not find it convenient to start from Columbus can get the advantage of the reduced rate, providing they can get a sufficient number to go in one party, as follows: From Cincinnati, $15.15; sleeping car berth, $4. From Cleveland, $11.90; sleeping car berth, $3.

In order that arrangements for a pleasant journey may be assured, the undersigned requests that all contemplating leaving with the Columbus party communicate with him, in order that ample sleeping car accommodations may be reserved.

The change in place of meeting was made by the Executive Committee, in accordance with a vote taken by the membership; and we hope that everyone who voted for the change will be present at the meeting, together with as many other gas men as can possibly find it convenient to attend.

Application blanks for membership can be obtained of the Secretary, who will be glad to furnish any further information.

A. P. LATHROP, Secretary.

BRIEFLY TOLD.

THE OHIO ASSOCIATION AND THE GAS EXHIBITION.—When the Managers of the Gas Industries Company conceived the thought that the novelty and usefulness of their proposed gas display, at Madison Square Garden, would be vastly enhanced could they succeed in inducing one or more of the regularly organized Gas Associations to hold their annual sessions at the Garden during the Exhibition, instead of at the times and places heretofore designated, the Managers seem to have "builded better than they knew." Although only one Association elected to forego the regularity which attends and follows the observance of rules laid down for such government, from the programme of the one that elected to disregard main precedent, it looks to us that the irregularity of its course is bound to redound to the material advantage of the tempter. The Ohio Gas Light Association elected to hold its meeting for the current year in New York during Gas Exhibition week, and whether or not such determination was out of the ordinary makes no particular figure just now; the fact is that the Association's programme for its thirteenth annual meeting is "out," and the further fact is that the numbers on the programme are of a sort certain to keep the Association before the attention of the fraternity at large, irrespective of whether that fraternity is or is not largely represented in person at the display to be provided by the Gas Industries Company. The paper list prepared by Secretary Lathrop, through the active assistance of the gentlemen who have promised to compose and read papers, is an excellent one; and the Association is to be congratulated on the readiness of its members in responding to the appeals of its officers for matter to carry out the best purpose or object of its founders. So we again say that the Gas Industries Company was happy in its thought that in Association there is strength. Meanwhile, we may and do say that the Exhibition is bound to be a success from whatever advance point it may be looked over; for the Gas Companies of New York city are a unit in their sensible support of its aims.

NOTES.—The preliminary action taken in Brooklyn, N. Y.—it is rather odd, by the way, that Brooklyn should or could be looked upon as a leader in anything that is of Metropolitan moment—respecting a reduced rate for gas in that city may fairly be taken as the way in which gas prices for Greater New York will eventually be settled. After much delay, the authorities of Brooklyn and the Brooklyn Union Gas Company, taking mutual advantage of the provisions of the Wray bill, have agreed on specifications under which the Company could make a bid for the public and ordinary lighting of the city, for a term of years. Briefly stated, the likely outcome of the negotiations will be this: For public lighting—$1 per 1,000 cubic feet for the first year, with a 2½ cent reduction for each following year, until the rate of 90 cents per 1,000 is reached. For ordinary lighting: $1.20 per 1,000 cubic feet for the first year, with a reduction of 5 cents per 1,000 for each following year, until the rate of $1 per 1,000 is reached. This agreement, which will more than likely be ratified, points to the beginning of the end on similar lines in New York.——Messrs. Jas. R. Floyd & Sons, of this city, have been awarded the contract for the construction of a cast iron, multitubular condenser, for the Standard Gas Light Company, of New York, the capacity of the vessel being rated to the passing of 5,000,000 cubic feet. This condenser, which is especially designed for the use of salt water, will have a maximum capacity over any heretofore constructed in this city. The Messrs. Floyd have also contracted with the proprietors of the Richmond County (Staten Island) Gas Light Company to remodel its purifying apparatus, by replacing the present wet centerseal with a 10 inch dry centerseal and connections, new covers, etc.——Mr. Amos Hadley, who served the Central Gas Light Company, of New York city, for many years faithfully and with success, has resigned from its service.——Mr. Benjamin I. H. Trask, who was quite prominent in the gas business a short while ago, from his connection with the Equity Gas Company, of Brooklyn, N.Y., died at his home, No. 6 East 82d street, New York, on the 11th inst.——The organization of the San Francisco Gas and Electric Company, which succeeds to the properties of the San Francisco Gas Light Company and of the San Francisco Edison Light and Power Company, has been perfected. The officers of the combined concern are: Directors, J. B. Crockett, Adam Grant, G. M. Prescott, J. D. Harvey, D. Murphy, C. R. Payson, J. B. Stetson, W. F. Whittier and C. E. Greene; President, J. B. Crockett; Vice-President, Adam Grant; Treasurer, W. G. Barrett. This list shows that the dominating force in the concern is by all odds with the "remains" of the Gas Company.——At the annual meeting of the Peoples Gas Light Company, of Jersey City, N. J., the following result was reached: Directors, T. Morris Perot, Thos. H. Williams, H. A. Coursen, F. Stevens, John J. Voorhees, G. W. Conklin, H. Wallis, S. H. Plum and S. D. Tompkins; President, T. Morris Perot; Vice-President, Thos. H. Williams; Secretary and Treasurer, E. R. Case.——We have received a letter signed "S.," postmarked "Boston, Jan. 11, 6 P.M." If "S." desires that his communication shall receive any further attention he will have to forward his name and address.

[Prepared for the JOURNAL.]

The Gas Rate Agitation in New York.

By MR. ARTHUR E. BOARDMAN.

The first guns have been fired, through the daily press, upon the prices for gas in the city of New York, and soon the forces will be assembled and organized for the attack upon the gas companies. The old war cries, so often and so successfully used in the past, will be again invoked to incite public greed, and the result can hardly be doubtful. The cost of the conflict will fall upon the companies, no matter what the apparent outcome may be.

We who have devoted our lives to the manufacture and distribution of gas, and have studied the questions relating to the respective duties of the companies and the public in their dealings with each other, will not be listened to by either of the contestants; consequently, repeated recurrence of these agitations may be expected. The daily newspapers will be flooded with communications from plausible but uninstructed writers, and with reports of interviews with professors of all the sciences, except that of gas making, which will be greedily read by the public, while the technical journals will be furnished with facts and figures, in refutation, which will be read by only the few who are already well posted on the subject. The judgment of honest and well-meaning officials trying to investigate these matters and to arrive at an unbiased conclusion, may well be mistrusted, in view of the character of the expert opinion which recently influenced his Honor, Mayor Strong, in the matter of fuel gas. While we recognize the wisdom of his conclusion, we are constrained to say that it should have been arrived at by very different considerations from that given by the newspapers as having been the prevailing one.

The clamor is now for "dollar gas," and however unjust it may be to the companies to place this price as the maximum one which they shall be allowed to charge, they will be forced to come to it in the near future. It will be in vain to argue that the 26 to 30-candle power gas, as furnished by the New York Companies, is now as cheap to the purchasers as is the 16 to 16.4 candle power gas furnished by the London Companies at present prices; and that under all conditions of cost of labor, material and capital, the New York prices are more advantageous to its inhabitants. Neither will it avail to point out the fact brought out in a recent investigation, that the gas supplied by the city's works to the inhabitants of Philadelphia is costing that city about $1.36 per thousand feet to deliver it to the consumer, while he is required to pay only $1.00 per 1,000 cubic feet for it—the loss to the city being made good by direct taxation of its inhabitants. The fact that the consumer in Philadelphia, and in several other cities in the country, is supplied with gas at $1.00 per 1,000 feet, or even less, is the only one that will influence the minds of the masses.

We, of course, know that the conditions bearing upon the cost of manufacturing and distributing gas in New York City, are very different from those existing in any other city in this country, and to a greater degree still than those affecting the industry in London and Paris. New York pays more for labor and all materials entering into the manufacture of gas, and has more duplication of mains and works, and hence larger proportion of capital per 1,000 feet sold, on which interest must be earned.

This is largely the fault of the public itself, because of its stimulating competition and the formation of rival companies, with the consequent duplication of mains, but it is also the fault of the companies in not meeting the reasonable demands of the public, until forced to do so.

The price paid for capital in this country, to be used in gas undertakings, is also higher than in London, as the risk to the business is greater. The loss from uncollected bills is also greater than is reported there, although this is hardly so large as we would be led to believe by some standard authorities.

While we are aware of all these handicaps upon the ability of the New York companies to profitably furnish dollar gas, it is almost impossible to make the people understand or admit them, and even a commission appointed to investigate the matter, and to report as to what would be a fair price, would, through the unprofessional character of its composition, be incompetent, in a limited time, to acquaint itself with the data necessary to arrive at a just conclusion. And if that conclusion should be different from that demanded by the public, the commission would be likely to suffer from imputation of being improperly influenced.

In view of all this, and to avoid in the future these periodical attacks, which in the past have so damaged the value of gas investments and

created so antagonistic a feeling between the public and the companies, is not this a fitting time to meet the demands of the people in a conciliatory spirit, and by mutual confidences and concessions place the business upon an equitable and firm foundation?

The public has rights and so have the companies, but where neither is willing to concede them to the other, continual conflict is sure to exist. The spirit of compromise and arbitration, which has accomplished so much in diplomacy, and which promises to accomplish so much more in the disputes between labor and capital, can surely be invoked to advantage in such a controversy as is now before us.

The low price for gas secured by the English public is not the result of agitation and oppression, but rather from the wise and fair enactments which made both parties share in the march of improvement and the exercise of economy. Fair rates for gas were established years ago, which, under the then conditions, admitted fair returns to capital and labor, and the companies were allowed to divide larger dividends in proportion to the decrease in price they made to the consumer. The result has been a reduction in price to the public of about 37 per cent., and a stability in good dividends which has made gas securities among the most sought after in the market. What has proved so satisfactory in England has been accomplished, in large measure, in Massachusetts, by the creation of a Commission, to which all questions affecting the price of gas and the duties of the companies toward the public are submitted, and by it determined. Such a Commission, by its length of service and the frequent exercise of its functions, becomes competent and expert in its judgments and methods, and its findings are generally deemed just and sound by all fair-minded people.

What has been accomplished in Massachusetts should be possible in New York, and the errors, if any, in the law appointing such a Commission and the limitations of its powers, could be rectified in New York through the experience gained in our sister State.

If the pending controversy is wisely taken out of the narrow circle of local politics, and made a broad and comprehensive question for the State at large to settle, for the present and for the future, upon a just and lasting foundation, it will be a fitting sequel to the recent victory for sound money and credit in which the Empire State played so noble a part.

Testing Gas Coal.

By Mr. Norton H. Humphrys, Assoc. M. Inst. C. E., F.C.S., in the *London Journal*.

I have read Mr. T. Glover's paper on the "Commercial Testing of Gas Coal,"[1] which appears in your issue of the 3d ult., and also the discussion on the same, with some amount of disappointment. The testing of gas coal is a very important subject; and I had hoped to find some advancement or improvement in details. But the only innovations in the set of apparatus illustrated are the introduction of two retorts instead of one, and the plan of drawing off a sample of gas for examination at a regular rate. No experimental data or other proof are adduced in favor of these, or to show how they aid in producing the superior results as compared with other forms of testing apparatus that are more than once claimed in the paper. While heartily agreeing with many of the conclusions advanced, I fail to follow the line of reasoning adopted in some instances; and with regard to others, while open to conviction, I should wish to see them supported by experimental proof. The general interest attaching to the subject must be my excuse for taking the liberty of freely discussing the paper, in the hope of assisting, to some small extent, in the advancement of the same.

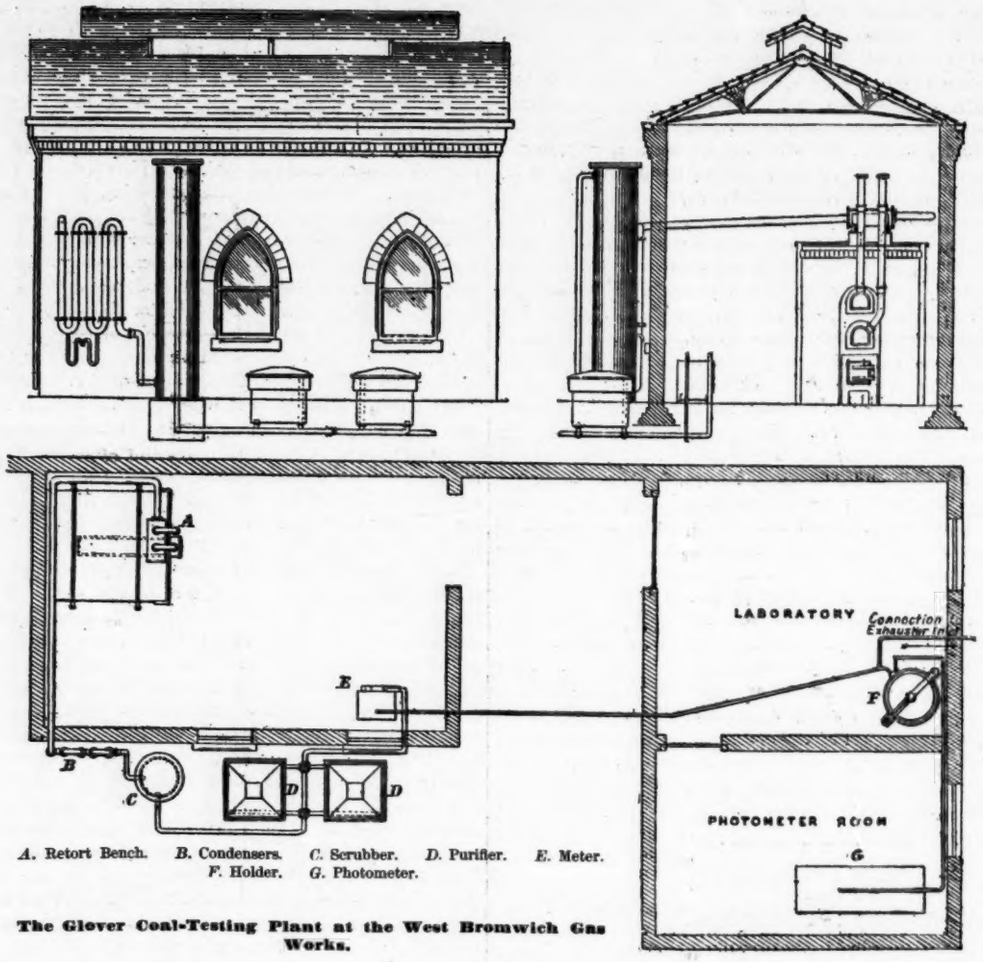
Every gas engineer rides his own pet hobby on this question of coal testing, and not unfrequently also carries a decided personal conviction that all tests which do not strictly conform to the said hobby are unreliable, if not useless. I will venture to go further, and say that the same individual changes in his attitude towards it from time to time; and this appears largely due to want of a clear comprehension of what the test is and what it is intended to show. We hear of laboratory tests, experimental tests, working tests and commercial tests. But these may be divided into two classes—the experimental test and the commercial test. Directly these are mixed together confusion arises, because the experimental apparatus cannot take hold of all the details of £ *s. d.* which are the principal features of a commercial test; while apparatus on the ordinary working or large scale brings in special sources of error, which take away from the definiteness that should attach to an experiment. An indispensable feature of any experiment is that it should be definite. If repeated several times, the results should be the same—or, at any rate, without appreciable variation. It is possible, with reasonable care and skill, to conform to this condition with a laboratory apparatus of the usual capacity, viz., $\frac{1}{1000}$ of a ton. But on the large scale there are practical contingencies—such as the condition of the sample, the way it is handled, the heats of the retorts, the temperature of the condensers and of the washing liquor, and the state of the purifiers—which prevent anything like a close approach to definiteness.

Each description of test has its proper place; but neither can supply or fill the position of the other. The experimental test gives us the practical character of the coal, by which it can be identified at any future time. The external characteristics, color of ash, percentage of volatile compounds, quality, quantity and composition of gas produced, percentage of coke and so on, together with its behavior during combustion and distillation, enable an experienced operator to classify it and assess its practical value. A moderate amount of practice in experimental testing renders the operator able to judge as to the desirability or otherwise of testing a few trucks of the coal in the usual way. So far it is a question of quantity and quality of products. But the commercial test brings in the question of £ *s. d.*, and to give a really reliable result, it should deal with ordinary working conditions of handling the material and its products, and of purchasing and selling. Every gas manager is engaged in making commercial tests of the particular kinds of coal specified in his current contracts. The experimental test tells us the intrinsic value of the material, and the commercial test shows if it can be made the means of satisfying the consumers and paying the dividends.

A very general impression seems to exist, to the effect that the experimental test should be a sort of standard, representing the best results that can, by the exercise of reasonable care and skill, be obtained in every day working; and it has been roundly abused because it sometimes appears to soar out of the reach of this very indefinite condition. If every gas works was an exact reproduction of one common plan, like the moulds from one casting, and subject to similar climatic conditions, it might be expected that the every-day working would be a definite quantity, and that the experimental test should closely approximate, or, at any rate, be in fixed proportion thereto. But remembering the varying practice in respect to apparatus and modes of working, is there much to be wondered at if the experimental and commercial tests sometimes run out to considerable distances apart from each other? While as a general rule the gas manager desires to get as much gas as possible out of his coal, and regards every additional 100 cubic feet as a gain, it sometimes happens that he does not care to gather up the last threads, as the extra few 100 feet may cost more than they are worth. The additional fuel, wear and tear of retorts, and purifying expenses may render them a loss rather than a gain. The idea of making the experimental test of coal a perfect and complete miniature of every-day working is a delusion. Should it, to be reliable, conform to the 8,000 cubic feet per ton of 1840, the 10,000 cubic feet of 1870, or the 11,000 cubic feet of 1896? There is no finality about ordinary every-day working, and it is notorious that in the case of two or three different gas works, each using the same description of coal, the results differ considerably. A test that happened to agree with the particular circumstances of one works, would be wrong as regards the others. The experimental test, therefore, cannot do more than give a correct description of the character of the coal. From this the qualified gas manager will be able to calculate, with tolerable closeness, its value at his own works. It is more valuable for this purpose than a commercial test, when the results are printed for the guidance of others; but what I wish to make clear is that printed results, whether experimental or commercial, must be viewed from the point of the reader's particular circumstances. It is not sufficient to know that certain results were gained with the coal; the inquirer has to consider whether he could secure similar ones at his own works, or how near he could approach to them.

It is quite true, as the author observes, that the results gained from actual working with his own experimental apparatus, will be more valuable than a mere perusal of printed analyses. An actual test, even if made in a rough-and-ready manner, gives an insight into the character of the coal that cannot be obtained by simply reading a report; but this is no discredit to the report. In regard to the printed report, also, the date at which it was prepared, and the manner in which the sample tested was obtained, are important considerations in assessing its value. An analysis that was made ten or fifteen years ago can scarcely be taken as a correct example of the characteristics of a coal at the present day; and a sample that has possibly been packed up in the pit itself, and conveyed high and dry to the test room, may be expected to give better results than an average sample from the gas works yard, which has received the usual transferring from one receptacle to

1. See Am. Gas Light Journal, Nov. 16, 1896, p. 796.



A. Retort Bench. *B.* Condensers. *C.* Scrubber. *D.* Purifier. *E.* Meter. *F.* Holder. *G.* Photometer.

The Glover Coal-Testing Plant at the West Bromwich Gas Works.

another, throwing out or tipping up, exposure to weather, etc, In the experimental test, the coal can be distilled at an accurately adjusted temperature in a perfectly sound retort—conditions which do not obtain in practice; but it is hopeless to attempt to discount these advantages, with a view of improving the "practical value" of the test. How can such matters as cracks in retorts, stopped ascension pipes, transit of coal for 200 or 300 miles, or exposure to six months' bad weather, be represented in a testing room?

The author thinks it advisable to make periodical experimental tests of well-known coals, and from the second paragraph in the paper, it would appear that the expression "well-known" refers to the coal which the operator has been in the habit of using in the ordinary way of business. He warns gas engineers that, if they continue to use such coals without observing such precautions, their confidence may be carried too far. But what creates "confidence" in a gas coal, or leads the gas manager to prefer it? Simply the commercial results. Let us assume that, whether by the aid of experimental tests or otherwise, the gas manager has made a judicious selection of coal. After he has had a few years' experience he knows exactly what he can do with the coal. He is also aware, if he possesses any powers of observation and reasoning at all, of the weak points of his carbonizing and purifying apparatus, and whether they admit of remedy. He may go on using the coal for 20 years, if the results continue satisfactory and the price is right, without the periodical experimental test. If the quality of the coal is not maintained, he will find it out from his working results, without needing to go to the laboratory to inquire; though if his results do show a failing, the experimental test will be very useful in helping to locate the cause. But so long as the working results are good, I fail to see the necessity for the periodical experimental tests, or why the results of such a test, if taken, should be likely to cause "no little surprise." Granted that the working results remain unaltered, an accurate experimental test should simply agree with previous similar ones, and would not be likely to elicit any information that was not known before. Apart from this question, as a matter of research the gas engineer will find it worth while to make experimental tests—especially with certain modifications of the purifying and condensing arrangements—and compare the same with his daily working. But I take it that the usefulness of the experimental test becomes more apparent in regards to coals that are not "well-known." A gas engineer cannot be sure that he has selected the coal best adapted to his circumstances, until he has examined all likely descriptions within reach. These may total up to perhaps fifty, and life is not long enough to make a commercial test of all. He must follow the example of Mr. C. E. Jones, who remarked that he had tested nearly all the coals in the Midland district. By this means, Mr. Jones has obtained an insight into the nature of some kinds of coal in regard to which a commercial test would have proved a troublesome and costly experiment; and the author himself gives an illustration of the advantage of an experimental test in regard to a new gas coal. I think that all who have made a habit of regularly examining samples of every fresh kind of coal, will occasionally make a lucky find, and hit upon a good article in a quarter, perhaps, where it was least expected.

Passing on to notice some of the details incidental to Mr. Glover's apparatus, I deal first with his assertion that, by using two or more retorts, and thus mixing the heavy gas from the first part of a charge with the light gas from the latter part of a preceding charge, he obtains better and more accurate results. Whether there really is any loss of illuminating value by the deposition of matters that might otherwise be retained in the gas, when working on the experimental scale, is a matter which I have never actually inquired into; but from the condition of the tar, and the fact that the illuminating value obtained from the single retort is almost invariably in excess of that shown by everyday practice, I should much doubt it. We know that in ordinary working some time elapses after the introduction of the charge before the proper gas yielding temperature is gained in the retort, on account of the cooling effect of such a large bulk of comparatively cold material; and heavy vapors escape that possibly carry valuable illuminants with them, and which, but for the diluting action of

lighter gases, would find their way to the tar-well. But this would not be so likely to obtain in a small iron retort.

It would be extremely interesting to know whether any improvement in illuminating value is shown by the author's system of two or more retorts, as compared with the usual single retort; but whatever the advantage may be, it is very dearly bought. With a single retort and gaseous fuel, the consumption of gas, and therefore the temperature of the retort, can be nicely regulated. The author's drawing shows an ordinary coke furnace for heating; but it would be possible to adopt gas heating, which I regard as indispensable to a reliable experimental test. Yet even with every care, the working temperature of two retorts cannot be so closely adjusted as that of one, and the two retorts also necessitate the introduction of the hydraulic seal—an objectionable feature in an experimental apparatus. However carefully adjusted, it gives a variable pressure on the retort, and if concordant results are desired, the pressure in the retort during the operation should be perfectly steady, and within a tenth or so of that of the atmosphere. My chief objection, however, to the use of more than one retort is that it prevents the rate of production from any one single charge being watched. With a single retort, the height of the holder can be read at any desired interval—say, two to five minutes—and the curve showing the rate of production is one of the most valuable indications of the practical value of a coal that it is possible to obtain. The author mentions hourly charges, but with the two retorts, how can he tell when the charge is completely worked off? He runs a risk of spoiling his test by opening a retort before the proper time, or of leaving a spent charge standing in the retort after it is worked off. With the single retort, the holder can be watched and the charge withdrawn at the minute that its carbonization is completed. I may be told that the hydraulic seal and the uncertainty as to drawing the charge are an approach to practical conditions. Perhaps so. But, as already remarked, if we once start at a reproduction of practical disadvantages in the experimental plant, where are we to stop? The duplication of the retort certainly serves to reduce the errors inseparable from another special feature—that of drawing off a sample of the gas at a regular rate, which is supposed to represent a fair average of the total make. But apart from this, I do not see how it contributes towards a nearer approach to accuracy.

Another special feature for which some advantage is claimed is the use of 56 lb. charges, bringing the consumption of coal up to 2 cwt. or so. It is claimed that the results obtained are of "much more practical value" than those based on the distillation of "a few pounds"—alluding, I presume, to the 1,000th of a ton testing apparatus. If there is anything in this idea, why stop at 56 lbs. It would follow that the nearer we approach to ordinary working, the more accurate the result, or rather the greater the "practical value." The 1,000th of a ton retort would be farthest away, and the two retorts with 56 lb. charges rather nearer, but still very far removed from ordinary working. If a representation of ordinary everyday results is the object sought after, why go to the expense of experimental retorts at all? The first cost and working expenses of such a setting as is shown in the drawing would be considerable, so why not isolate a particular bed of retorts, and arrange a small condensing and purifying apparatus for dealing with the make therefrom? Of course, proper precautions must be taken in selecting the sample, whether large or small; but, given a sample weighing 2 cwt. or so, I fail to see in what way the carbonization of the whole bulk is likely to give more accurate results than the selection of fair average samples therefrom. In analyzing oxide, lime, liquor, etc., it is usual to operate upon much smaller quantities than 2¼ lbs. Why not claim that oxide should be tested by the 56 lbs., or that ammoniacal liquor should be analyzed on the 100 gallons, as the results thus obtained would be of "more practical value" than those obtained from the 100 grains or the 50 septems in the usual way? I contend that 2.24 lbs. is in every way a more convenient quantity for accurate operations than 56 lbs. While not so small as to interfere with fair sampling, it can be readily weighed out to within less than a grain. I have repeatedly taken four to six charges from a large bulk; and the regularity of the results has shown that the sampling was everything that could be desired. The coke can be collected and weighed with equal delicacy; the liquid products are obtained in convenient quantities for measuring or analyzing, and the same with regard to the impurities. The whole of the gas, being collected in one vessel, can be dealt with in any desired way; and I am therefore not only unable to see where the advantage of enlarging the apparatus some forty-fold would come in, but think there are decided objections to doing so.

The author mentions that the coke should be weighed hot. But a very better plan is to weigh it cold; and I am under the impression that this is the usual practice. Red hot coke exposed to air loses weight by combustion; the induced current of hot air interferes with the steadiness of the scales; and the heat interferes with their accuracy. The plan of weighing hot is preferable to quenching with water and leaving the coke to drain or dry for twelve hours which has been suggested; but my own practice is to provide a light wrought iron box, so shaped as to fit snugly under the mouthpiece. The charge is drawn rapidly into it; and the lid, which is close fitting and has a rim about 3 inches deep, is placed on. In an hour or two, the box and its contents will be cold, and can be weighed. The coke is then emptied out and the empty vessel weighed. By this means, the weight of the coke is obtained without risk of loss by handling; and the difference between charges from the same sample will not exceed 10 grains. I have noticed that the coke smothered in this manner is more friable than it would be if extinguished with water—a fact that must be remembered if it is desired to estimate the quality of the coke.

The plan of drawing off a sample of the gas at a regular rate, to represent a fair average of the whole, is defective. If the production was always regular, it would secure a fair sample; but this condition is impossible of attainment. The two retorts tend to "level up" to some extend; but even with them, the rate of production from minute to minute will vary with every kind of coal. To get an accurate sample, the proportion between the total make per minute and the quantity withdrawn per minute must be constant; and this is impossible where one is fixed and the other variable. Those, however, who are in favor of sampling the gas made, should refer to the description of Mann's proportional meter, given in "King's Treatise," Vol. I., p. 98, which is an apparatus that would ensure fair sampling. I also gather that Mr. Glover depends on the pull of his exhauster for relieving the pressure on the retorts, which is a somewhat rough and-ready way of proceeding, and does not admit of such regular working as is practicable when the gas holder is weighted or counterbalanced to adjust the pressure.

Mr. Glover's results are greatly discounted, from an experimental point of view, by their silence in respect to the liquid products. It is not a question of the practical value of the tar and liquor, but of checking and balancing the results. If worth doing at all, coal testing is worth doing well and completely; and one cannot be certain as to the correctness of his results unless the whole of the products are collected and a kind of balance sheet made out, showing that the weight of coal used is represented by the gas and products. How else would such a thing as a crack in the retort, a small leak in the apparatus, or an error in weighing or measuring be detected? The quantity as well as specific gravity of the tar is also an important point in estimating the practical value of the material, especially when dealing with an unknown mineral of which only a small sample is obtainable—such as (say) Japanese or Australian coal. Another disadvantage connected with such a large set of apparatus, is that the condensers, scrubber and purifiers are outside the building, exposed to the vicissitudes of the weather. They are therefore subject to changes of temperature which may cause trouble, and are not conducive to accurate or to definite results.

After having shot with so much freedom at Mr. Glover's views upon coal testing, it is only fair to give him a chance of retaliating; and so I will conclude by outlining the special features of a testing apparatus which was arranged some fifteen years ago, and has been regularly used ever since: One cast iron retort, heated by a Fletcher's gas burner, the latter fitted with a meter and regulator; ascension and other connections throughout 1 inch bore; ascensions short, surrounded with a water jacket, terminating with a cross piece. From this a short horizontal, terminating in a second cross, with rising pipe to the condenser; to the lower limb of the second cross the "tar vessel"—a tin cylinder or bottle, with the neck formed of a piece of 1 inch pipe, so that it can he screwed on and off—is attached. The condenser consists of a 2 inch pipe in one straight length, with a fall towards the inlet, and the length can be varied; then two scrubbers and the dry purifier; and, lastly, the holder. If necessary, a small tar extractor can be introduced at the outlet of the condenser, and the scrubbers or purifiers are detachable. In fact, the arrangement of apparatus from the tar vessel to the holder is so designed as to be varied according to the kind of coal or oil being operated on. The whole is arranged to admit of cleaning out from end to end by the removal of plugs or covers. There are pressure or sampling tubes at intervals, and a connection from the gasholder into the photometer room.

Mr. A. B. Wilgus, Jr., and the others interested in the projected establishment of a gas works at Dover, N. J., are seemingly satisfied that the population and circumstances of the district warrant their going on, for they have applied to the City Council for a franchise.

Defects in Cast Iron Castings.

By "A Foreman Moulder," in *Engineering*.

As a practical man, I have been led to take up this subject largely on account of the discussions which have been carried on of late by men claiming to have more than ordinary authority to speak on the question. The metallurgy of cast iron being a wide field of research, it is but natural to suppose that there will be diversity of opinion. This being admitted by metallurgists themselves, I shall only attempt to deal with the practical aspect of the question, and leave all controversial matters regarding the physical properties of cast iron to the specialist of the laboratory.

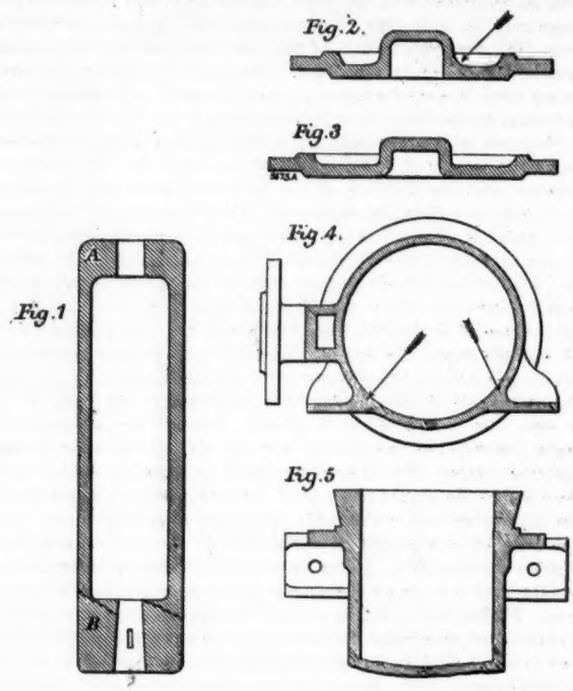
Much as I value the work of the chemist in determining the properties of cast iron, it is of very little use in foundry practice, as it does not concern itself so much with the properties of the body as with the way the various constituents distribute themselves. This reminds me of an article which appeared lately in a mechanical journal on the physical properties of cast iron. The writer, after elaborating at considerable length to show that the top end of a vertically cast casting has the greatest specific gravity, goes on to say: "The test of the parallel gate which the author conducted, tended to show the fallacy of the idea that the lower end of vertical poured castings must be of greater specific gravity than the upper end." The above is contrary to all my experience, and to the opinions of such practical men as I have come in contact with. I know of nothing which can give increased gravity and density to metal in a fluid condition, unless it be compression. How any one purporting to have a knowledge of metals could make such a statement is beyond my comprehension; any mechanic with a junior understanding knows the importance of casting "face down."

In my experience of casting rams, I never had any trouble with the bottom end being defective, and the same is true of all other similar castings when cast in a vertical position; indeed, any practical man seeing a ram for the first time as it came polished from the turner's hand, would have no difficulty in determining which was the lower end of the casting, as the top end invariably shows a more markedly speckled surface when finished. This speckled surface is caused by the impurities, which are the lighter items of the body of the metal, rising to the highest part in the vertical position at time of casting. This defect would be more pronounced, were one foolishly to attempt to cast a ram with No. 1 grey iron, as there would be such an accumulation of graphite at the top end as to make the metal scarcely recognizable as cast iron. This would be more so if the metal happened to be rather dull at time of casting.

The question may be asked, Is it necessary that rams should be cast in the vertical position? To this I say it is absolutely so, and no good is likely to come from attempting to cast in any other position. In order that I may be more easily understood, I refer the reader to Fig. 1, which shows a ram as it is cast. *A* is the top end and *B* the bottom; a ram cast in any other position than this is not likely to give satisfaction. I have known of rams giving way under tensional strain while working, at the points indicated by broken lines in Fig. 1, the reason being that they were not solid on account of *B* being the top end at time of casting. It may be that some one will say all this difficulty can be overcome by feeding. My experience teaches me differently, although it can be minimised to a certain extent by such aid, it never can be mastered, as the pouring gates are too small to give the moulder sufficient time to completely solidify his casting, since he is compelled to retire at a time when the fluid metal is still contracting, the result being an imperfect casting through drawn or vacuum holes. Be it observed, there will be nothing visibly defective to the naked eye, but just as sure as it is a casting the interior will be as described.

It is common to apply a sinking head as a cure for this evil, but unless the casting has at least 1 inch to every foot of its length, this device is useless. Even with this extraordinary length of sinking head I have seen castings as often defective as otherwise. The cost of cutting the sinking head off is no inconsiderable item, and has its proportional outlay in the foundry also. These two points confirm the necessity of casting the plug end up, as the plug end has but little tensional strain while working, the greater proportion of graphite at this end is not a serious matter. Moulders, as a rule, prefer the cotter end to be the top end while casting, as they have a dread of the cotter core going to pieces on account of the long drop the metal has to the bottom of the mould. No doubt if one looks at the long drop of from 15 feet to 20 feet his dread is not without cause. A cotter core at this depth is almost an impossibility for the fettler to get out of the casting, therefore the better way is to cast the end solid, and bore and slot the cotter hole, which gives greater satisfaction with no additional cost.

How can there be anything but increased density at the bottom of vertically poured castings? Taking iron to be 7¼ times the specific gravity of water, what an enormous compression there must be at the extreme bottom of a casting 15 feet or 20 feet from the pouring head.



The idea of a casting solidifying from the bottom upwards, and its molecules becoming more dense as it rises towards the top end, is contrary to experience.

Fig. 2 shows the back cover of a cylinder, as it is often cast. Such a casting is often defective round that part to which the arrow points. The metal, as seen at the arrow, being ill arranged, results in a dirty looking casting, the turner being unable to get the polish on it desirable. At first sight, to many this defective surface looks to be dirty metal, it being so badly speckled on the surface; but a closer examination reveals the fact that it is porousness which is caused by the badly proportioned form of this particular part of the casting. The porosity is quite visible all round in the region of the arrow, and at times it is so bad as to condemn the casting, this porous part being insufficient to withstand the cylinder's working pressure, in consequence of which the cover is liable to sweat, making it an objectionable casting. The engineer ascribes the defect to dirty metal and blames the founder, while the fault is his own. Having shown the cause of defect, Fig. 3 explains how to obviate this evil. In this figure you have a well proportioned design. It requires no great practical understanding to observe that immediately on casting such a mould the process of solidification sets to work over the whole body at one and the same time, and with ordinary mixed metal, suitable for machinery castings, no one need have the least fear of defectiveness in such a casting. Fig. 4 is a section of a horizontal cylinder through the feet. In introducing this figure I do not intend to explain in detail how to mould a cylinder, but just, as it were, to put my finger on the diseased part of the casting, explain how it is caused, and how to obviate or remove a difficulty which has been the cause of so many bad castings.

As the position of casting has something to do with the point at issue, I cannot rightly pass over the question as to the position a cylinder should be cast in. In this question there is a wide range of opinion, some casting one way and some another, each being more confident than the other that his is the right way. As the writer's experience is in favor of the vertical position, this figure must therefore be viewed from that standpoint. On the foot, as shown at the arrow, is the old defect of disproportionate metal. At this part of the foot a monster fillet is often put on with the intention of strengthening it. This may at least double the average thickness of metal, to which must be added the brackets of the feet which attach themselves to the barrel. There is at this part an excessive thickness which causes the metal to be spongy, and unless the moulder makes provision for feeding, or uses some other means, there can be nothing but defectiveness. No pouring gate must be put on this part of the casting, as at the arrow, such

a gate being too small to give the moulder an opportunity to thoroughly solidify with the feeding-rod. What is wanted here to get the feeding done properly is a large riser in direct communication with the spongiest part of the foot, the feeder to kept at work until all draw or contraction is over; the sinking head should be made about one-half heavier than the body, as at Fig. 5. There is no good in attempting to feed if there if there is nothing fluid to feed with; indeed, the feeder would simply be caught in the gate, and the moulder's opportunity for good would be lost, the defect being only apparent at the facing of this part of the casing.

In conclusion, as a practical man, what I would like to impress upon moulders is to seek to penetrate beneath the surface, and master the intricacies of their trade. Make a good mould, and you will have every chance of a good casting. Go into all the nooks and crevices and find out the weak parts, and the strong parts will take care of themselves. Never look upon trifles as of no consequence, for by the merest trifle neglected you may cause enormous loss to your employer.

The Improvement of Coal Hauling Machinery.

Read by Mr. Reuben Street, Western Pa. Central Mining Institute.

The question now asked is, "What is the most advisable system of haulage under the conditions of our mine and mining plant?" Then we have to consider the system best adapted to the grades with which we have to contend; the manner and cost of reducing them to their minimum or to a level, if possible, in order to reduce the amount of power necessary, the cost of plant, its operation and maintenance in performing our work. If after this has been carefully considered, we find our grades greater than that considered practicable to any particular kind of haulage, we have to look for something practicable to our purpose and use. There is considerable difference of opinion as to what grades are practicable with the different systems; but the fact remains that many mining engineers agree that when grades are as high as 3 per cent. or more against the loads, traction haulage is not to be considered so efficient as rope haulage; while where grades are not greater than 2 or 2½ per cent. traction haulage may be very successfully used, but other things must of necessity be considered.

There are now three systems of haulage in general use, and while these have their different lines to suit their different locations, the systems remain the same. We will class them as they are generally classed as rope haulage, compressed air and electrical; each of which has its advocates, its adherents, its users, each claiming for his favorite system advantages over all other systems. Into the discussion of these varied and different opinions and systems we do not desire to enter, leaving to each the open field of competition and success.

We will notice the different systems as they appear in general use. Rope haulage consists of three kinds, commonly known as gravity, endless rope and tail rope. Each one may be used, and to good advantage under different conditions. Gravity or single rope is that used on slopes or planes where the load is drawn up by steam power while the empties are lowered by gravity or friction, the grades being steep enough to draw the rope back to the place where the loads are to be received, or the reverse—the power drawing the empties back. Where this system is used the haulage is generally short and steep—it is sometimes used in connection with some other kind of haulage. The machinery is of simple form and construction, being generally a single cylinder aud single drum and brake with movable clutch on the shaft. The engine can be set under the trestle which forms the tipple or in a direct line with the slope or off to one side by the use of wheels or sheaves. Another system of gravity plane is that where the loads are let down from a higher to a lower plane, pulling the empties up as they descend. This kind of inclined plane is used often with two separate ropes, each attached to a drum at the top of the incline, the drum being controlled by a friction brake. The large outputs of many of the river mines are lowered in this manner, which is a very safe and cheap mode of operation.

Tail rope will next receive our attention. This system of haulage has grown rapidly in favor since its advent. As a power it has been improved upon until it has come to be regarded as a safe haulage under almost any of the conditions of our region. It consists of a pair of engines, or engines with double cylinders varying in this region from 12 by 24-inch to 16 by 32-inch cylinders, two drums, one for the pulling rope and one for the tail rope, which wind the rope alternately as they are reversed to take in the trip or draw it out. These engines are generally geared by cog wheels to increase their power and reduce the speed of the trip to a safe speed for travel. In some cases engines of the first motion are used, which increases the speed and under favorable conditions would largely increase the output of a mine. The ropes consist of a pulling rope of a varied diameter to sustain the amount of strain produced by the work. This rope is long enough to reach from the engine to the place where the loaded trip is collected, commonly called the double or trip parting. The tail rope is generally lighter and is double the length of the pulling rope. This is necessary on account of its being coupled to the back end of the loaded trip. It travels with the trip, and where the grade falls for a long distance is made to act as a brake to hold the trip from running too fast and crowding itself upon the pulling rope and cutting it in pieces. A device may be used which allows the rope to become detached from the trip and permits the trip to run past the end of the rope and on over it without causing it to become entangled with the wagons or sheaves until the trip reaches the bottom of the grade, where the rope can again be attached and the trip pulled out. When the trip is ready to return the tail rope is attached to the front end, and is the pulling rope for the empty trip, the pulling rope proper being drawn back again attached to the other end of the trip. Thus each rope in turn is pulled in and out. The amount of coal hauled at one trip varies according to the conditions and the power applied. It is only justice to say that the increased tonnage at many mines by use of this system and its displacement of so much mule power have made it a favorite among the different systems. Its adaptability to the varied conditions of our seam has also helped to give it the place it occupies. The engines can be placed at either end of the haul, if a shaft is made for the inside end, or an air shaft may be used if located at almost any point near the line of hauling. The place generally adopted is at the front end of the work, this being generally the most accessible point for all purposes. The curves and sheaves should be placed with great care and precision to avoid loss of power by friction. The trips vary from 20 to 50 wagons at one trip, and much more has been pulled on different occasions at many mines. At places it has increased the output fully 100 wagons on each day's work and displaced as many as five mules and their drivers, the increased number of wagons being hauled by the same number of mules on the inside gathering the wagons to the double parting. This is accounted for by the drivers not having to wait on empties for return. Such plants, costing from $10,000 to $15,000, are now delivering from 600 to 1,000 tons of coal a day at the mine entrance and haul it from 1 to 2 miles. The life of ropes depends very much upon the care given them, by being well filled with oil and tar, and keeping them working on rollers instead of scraping the ground and over dirt and iron rail. Under favorable conditions they have lasted from four to six years.

Endless rope is the next to be considered, and under proper conditions it forms a very satisfactory haulage. It consists of a pair of engines of generally about the same size cylinders as tail rope. It has only one rope, which, as the name implies, is endless, and forms the entire circuit from the engine to the place of haulage, coming back to the same drum or wheel. There are two narrow drums. The rope makes two or more turns around each drum and then passes to a sheave mounted on a tension truck which is for the purpose of taking up or giving out, as may be required in the operation of the plant. This system requires two tracks, one for the passage of the empties and one for the passage of the loads; or it may be operated by carrying the one rope in the same manner as the tail rope, and having it travel in and out just as the tail rope; but this prevents that continuous delivery of coal at the tipple given by the double tracks, and lowers the tonnage unless the machinery is run at greater speed. The cars are put on the rope either singly or in pairs, or even more; but under true endless rope, each car has its own attachment to the rope, the wagons are delivered singly at the dump, and, as they are dumped, placed on the return rope, thus keeping up a constant arrival and departure of cars. This system has an advantage where the grade is in favor of the loads, which assists the power in taking in the empties; or where the seam is undulating in such a manner that the hills cannot be cut down, loads are put on the chain in such position as will help to pull other loads up an opposite grade, thus reducing the power required to a minimum.

Compressed air as a motive power has its advantages, and is used in some mines with very favorable results; yet it has not gained the place among motors that some other systems have. It consists of an air compressor or engine that compresses air into the receivers of the engine or locomotive at high pressure. This volume is consumed in the same manner as steam to propel the locomotive. The capacity of the boiler or receiver, together with the pressure of air necessary to run the required distance, are the things to be considered. Supply stations can be placed at any desired intervals. The use of these, however, requires

time, which must be made up by an equivalent, either in cheapness or adaptability to existing conditions.

The latest installation of this power of which we have any record is mentioned in the *Colliery Engineer*, May, 1896, in the following language:

"The compressed air haulage plant at Glen Lyon, while by no means the first, contains some essential improvements in the details of installation that especially commend it. It is the perfection of these details that in a large measure determines the efficiency and economy of a plant. That this installation has proved a success is evidenced by the fact that the officials of the Company have ordered a second compressed air locomotive and sufficient pipe to extend largely the scope of the haulage. The length of pipe used is 4,369 feet, three charging stations being used in this distance. The locomotive runs about 217 yards past the end of the pipe, making the distance of the haulage about 5,020 feet. The grade is in favor of the loads from 1 to 2½ per cent. The time occupied in charging the locomotive is about 1½ minutes. The pressure is from 550 to 600 pounds. The storage tanks are like two boilers placed on each side of the engine and over each cylinder, and are tested to about 1,000 pounds hydraulic pressure per square inch. Another tank is placed below the two mentioned, through which the air is fed through a specially designed throttle valve, thus preventing waste of power. The motor now in use has the power of hauling 16 empty cars back to the inside, starting with about 570 pounds pressure and returning with the same number of loads to the shaft; having left after making the round trip a pressure of 100 pounds. The weight of the empty trip is about 60,000 pounds, and that of the loaded trip about 166,000 pounds. The engine travels from 25 to 50 miles a day as may be required in its work."

Thus it is seen that each system named has its advantages over each other in different places.

Electricity, the power of the gods, is being used in many places, and like the other systems, has its advocates among the many users of min ing power. When we stand in the room where this power is being generated, we cannot help but wonder at the progressive influences at work among our mines and the splendid mechanical and scientific genius of the men that have brought this power so near to us. The elevating influence of this generative machinery for better and finer work must certainly be felt by the men who come in contact with it. When we gaze on the bright, shining dynamos making 500 or more revolutions per minute, sending forth an unknown—almost unexplainable—power along its different lines, hurling along the mine tunnels its great trains of mine cars with its motor of from 10 to 13 tons weight at the rate of eight or more miles an hour, who will say that mechanical haulage in its various systems is not capable of meeting every feature of our mining region? We find that where data has been given from work done, that among the first plants installed a motor with a power of about 220 voltage is capable of hauling 700 pit cars 3,000 feet in 5½ hours, leaving the remainder of the working day, 4½ hours, for contingencies. The motor runs about 21½ miles, being reversed 230 or more times during this period. Like in other systems, the size of trip varies. Trips of from 40 to 60 cars are drawn over grades of 1½ per cent. against the load for a distance of 1,000 to 1,500 feet at a speed of about eight miles per hour, the output being about 800 tons of 1½ coal per day.

The weight of rails used for haulage generally is from 30 to 45 lbs., with ties 4 by 6 inches or 5 by 6 inches of good solid oak laid so as to keep the rails solid in their places. This is one of the secrets of successful haulage of any kind. "What," you say, "good roads in a coal mine! Impossible!" Gentlemen, you may have the best power applicable to your plant and all the other requirements necessary to successful operation, but without good roads you cannot succeed. To-day you need the piercing keeness of the eagle's eye, the sharpened ear of the mouse, and the quickest perception of the mind it is possible for you to attain, if you would hold your standing among the advancing, progressive influences being established around you.

Think of power being distributed from one general plant to different mines where the haulage, pumping and ventilating machinery of each is run, each being capable of controlling and managing its own machinery when the general plant is in motion. Think of coal mine tracks carrying a locomotive or motor of 10 tons weight containing within itself 80 horse power; then look and see, if you can, the old mule dragging his weary limbs with his tired sluggish gait, stumbling over the ties into deeply trodden holes, and when too worn out to pull his load stand and kick, and paw until the driver and whip-worn mule agree to wait the kindly assistance of miners, who with shoulders to the cars help over the pull or summit of the hill rather than wait the delayed return of wagons. Who sighs for the good old days? None of us, because we have learned that we must stand ready to put in use the present means. If we would succeed we must investigate the different systems of power being used, and in our investigations we must throw aside any prejudices; we must see each with unbiased mind, calculate its cost, its results, its adaptability, and the benefits to be derived from it. We have before us men who use the different systems and would not exchange their present plans for any other kind. We have their work for a guide, and from this we may be able to gather information that will enable us to select a plant equal to the best.

We must notice also the mines where mule power alone is used. This may in many instances be improved by the care exercised in keeping up the roads. A heavier rail in some places and a better system of ballasting in others, and keeping the holes well filled would enable the mules to get better footing and pull greater loads. The keeping of water and mud off the roads is very essential, and where no drainage is available a small sump to collect the water and a small pipe attached to pump or hose on a movable truck would often be of great service. Remember whatever is saved in neglecting roads is generally lost in the extra power; it matters not what kind used. The loss of time is greater than would be necessary to maintain good roads at almost any cost. The reduction of hills, although small, often gains a wagon each mule trip. We have instances where loads have been pulled over grades for years which, when reduced at their summits 15 or 18 inches, have allowed the trips to be increased and a saving noticed of from $1.75 to $2.50 per day on three and four mules. Again, a swamp was raised up over which three mules were pulling only six wagons. After raising they pulled 20, and on several occasions, more.

A small double engine erected at the top of the steep grades has frequently helped to increase the output, displace mules and drivers, and removed the risk of killing mules on such grades.

Thus the mining practices of this region are before us. We have every known kind of power in use under various conditions, all of which are open to our inspection. Let us benefit by these examples.

The Destructive Tendency of Competition in Public Service Functions.

By Mr. Fred de Land, in *Electrical Engineering*.

The public rarely appreciate how carefully their best interests are being guarded when the authorities insist on a careful investigation of the necessity for establishing a competing plant for the supply of public service in any form, and are apt to bitterly criticise should it be decided that the field is not of sufficient size to properly support two or more companies. And yet such an adverse decision is often the soundest of approved economic policy. For with the growth in population and the development in service, one improvement after another can be easily added by a corporation doing a profitable business, assured of the safety and permanency of its investment, and not burdened with the heavy fixed charges that are ever the accompaniment of unnecessary invested capital.

But if the authorities thoughtlessly grant a franchise to a second company that proceeds to spend much money in establishing a competing service to supply a field already well covered, then the pioneer company must necessarily curtail its expenditure and is justified in keeping its outlay safely within its assured income, more especially if it believes that ultimately it must assume the burden of paying the fixed charges on this second and needless outlay of good money. To be sure, there is a lowering of prices—a rate war for a brief season. Then the character of the service may degenerate, and for a period it becomes a struggle for a mere existence without thought of possible profits. And then the old story; either one company buys up the other, or there is a pooling of rates, or the territory is equitably divided, or there is a secret agreement on rates, or one company is forced to the wall and its entire investment lost. But, in any event, the public are the losers and must indirectly make good the sums lost during the rate war, as well as the additional fixed charges on the unwarranted and ill-advised second investment.

For persistent and unyielding are the demands for dividends on invested capital, and dividends ever take precedence over improvements, however much the public may desire the latter. In other words, competition often retards or prevents the introduction of much-needed improvements in public service functions, and thus the public are indirectly defrauded out of their just rights by the action of the authorities in admitting competition on the false plea that the public will be benefited.

Now, in Europe they have decided to act more sensibly in these matters. Costly experience having taught that the public is always the loser in the long run, the authorities prohibit competition in public service supply, but safeguard the interests of the consumer by making rate reductions compulsory whenever the dividends exceed a stated sum or percentage. The wisdom of this excellent policy is shown in repeated reductions in rates, in the improved quality of the service, and in the large sums constantly expended for improvements that tend to lower cost of production or to increase the efficiency of the service.

Of course, it is an easy matter to conclude that where the rates of the new company are fixed by the terms of the franchise and in accordance with the desire of the applicant, that the public must necessarily be benefited by competition, if as good service as is now given is supplied at the lower rate. But if the new company finds that it cannot secure an income from the rates allowed by the ordinance sufficient to justify the expenditure necessary to operate and maintain a service that will be satisfactory to the consumer, then it can increase the rates regardless of any prohibitory clause in the ordinance granting the franchise. For the higher courts have held that where a city council passes an ordinance fixing the price for a form of public service at a rate that experience has shown cannot cover the cost of production and yield a fair return on the investment, then such an ordinance is fraudulently passed, and imposes no obligation upon the company accepting it, though it may leave the company in possession of a valuable and unconditional franchise.

The Recollections of a Country Gas Manager.

By "An Old One," in the *Gas World*.

Although possibly much more free from worry and anxiety than the manager of a large works, the life of the person responsible for carrying on a small country undertaking is by no means a smooth or uneventful one. The country manager is frequently expected to turn out good results with the cast-off clothes of a larger concern, and to get along with apparatus that has been rejected as obsolete elsewhere. The provisions for purifying and storing are anything but liberal, and there is generally only one practical man besides himself at hand to tackle a breakdown or other sudden emergency.

This condition of things is not without its advantages to a young and energetic man, as it brings him into contact with details that would be left to a subordinate in a larger works. With a complete working staff at command, he might give orders for a patch to be put on a purifier cover, or for a furnace to be relined, and do no more towards it, in a personal sense, than coming round to look and see that it had been properly completed about the time that he would expect it to be finished. If a live main was to be stopped off, all the details of drilling and bladdering would be left to the mainlayer, and the screwing and cutting of threads would be left to the fitter. But in a small works there is no regular fitter or mainlayer, and the manager may have to do the work himself, or, at any rate, to stand by and direct every detail of the operation. This is at the bottom of the well-known fact that many men who commenced early in life, as managers of small works, have eventually attained to important positions in the gas engineering profession, and are able to take a place with those who have had a much better education than themselves. Of course, the selection of a young man to a responsible position implies the possession of a certain degree of ability, and also steady and reliable habits of character, that, no doubt, serve to fit him for a larger sphere. But apart from that, the small gas works is a good all-round school to the painstaking and observant student, and affords special advantages that cannot be obtained in a large works. The small plant, in fact, can be treated as an experimental set, and it offers facilities for investigating make per ton, quantity purified per bushel of lime, sale per ton and so on, that do not obtain amidst the numerous conflicting details that gradually creep in as the concern grows larger. In a small gas works it is easy, for example, to measure every foot of gas used, in addition to that delivered through the meters in the usual way; but that would be scarcely practicable in a large works. And I think the gentlemen above mentioned are indebted, to a large extent, to the facility and accuracy with which working statistics of all kinds can be arrived at when operating on a small scale. As an educational system, then, the gas works in a village or a small country town offers facilities that do not obtain in any school of science, technical class, or other modern institution. And in the "forties" and "fifties" it was probably the best extant. At any rate, it was the only one available for young men outside our larger towns.

The editor of the *Gas World* has asked me to jot down a few of my notions and experiences for the benefit of his readers. It is very kind of him to put it like this, but I can scarcely hope to offer any substantial help. But though not claiming for them any degree of practical value, they may excite some interest, as opening up a few pages of the past that are not familiar to the young, and possibly just out of the range of the middle aged, and are becoming more and more like a closed book, as one after another, according to the order of nature, passes away from the scene of his earthly labors.

The most notable differences that strike one when comparing the present routine from day to day in a gas works with that of forty years ago are due to the spread of education amongst the working classes. With improved apparatus, suggested by practical experience, many of the bugbears of a country gas manager's life have been cleared away one by one, and in most cases he is free to take up the sale of incandescent burners, to show his customers how to use cooking stoves, and so on. With cheaper gas and improved ways of using it, the small gas works as we knew it forty years ago is gradually disappearing. The little concern doing about 5,000,000 a year—sending out 100,000 to 150,000 cubic feet per day in the winter and next to nothing in the summer—has grown to 20, 30, or 40 million, and passed from the small gas works stage to that of the medium-sized one. Where one or two all-the-year-round men, with a little unskilled labor in the winter, formed the whole of the staff, we now find half-a-dozen to a dozen good hands. But the changes in apparatus, though by no means inconsiderable, are not so marked as those due to the better education of the men. Every man can now read well and write distinctly and correctly, and the slates and memorandum books of the old days have given place to well-written time sheets. But in former days, when half the men could neither read nor write, and the other half was only self educated in a round-about kind of way in that respect, the difficulties in deciphering the slate from the retort house, or the daily time-sheets of the service layer and meter inspector, were very real. Each man had his own peculiarities of spelling and diction, rendering his records next to illegible to the uninitiated. And it was as useless to try and get these errors remedied as to attempt to turn a donkey away from a bundle of hay. In these days, when we find the young artizan has passed the seventh standard at the public school, and also acquired a fair knowledge of science and art by attending technical classes, it is almost incredible to believe that men should habitually inscribe such words as "meater," "comple pipe," "eny," etc. I understand that a system of spelling by sound—such sound having its own especial representation—has lately been put forward as a new thing. But the truth of the hackneyed proverb that "there is no new thing under the sun" is proved by the fact that such an idea formed the groundwork of the eccentricities above instanced. The surname of a new customer, after passing through a servant's pronunciation of it and the gasfitter's transcription of the same, sometimes blossomed out into a form quite different from the original. Even the names of the men themselves got altered from the original that appeared on the certificate of birth, if there ever was one, about which there may be some doubt. Many men were not only totally unable to spell their own surnames, but were also devoid of any notion as to their correct ages.

Education has led to the displacement of the old order of retort house hand, who is as much a creature of the past as a post-boy, and as extinct as the dodo. One of his chief characteristics was a spirit of philosophical calm, on which the anxious worrying temperament that is the chief feature of our present bustle and hurry in the way of life is not altogether an improvement. When he drank too much—an event that happened more frequently than it should have done—he was civil to his master and good-humored with his mates, instead of being inclined to be abusive to those in authority and anxious to fight somebody smaller than himself, as usually happens now. This may be due to changes in the temperament of the men or to changes in the composition of the beverages supplied to them—I will not pretend to say which. The calmness of mind was attended with a corresponding deliberation of movement of body which nothing could disturb. If a gasholder column or a chimney stack were falling in his direction he might quicken his pace, but, like the horse that would not start till a fire was lit under him, no ordinary event could disturb the even tenor of his way. Such an event as the gasholder running down rapidly at eight or nine in the evening, so that its contents came to be counted by rivets instead of by sheets, did not upset him at all. He simply remarked that "it was no use to expect things to go right always," and proceeded to lay the luting on his cover, after charging the retort, with the customary ease and deliberation. He had a stated time for changing the

purifiers, and regarded "the stuff in the bottle and the bit of paper" as a useless fad and an absurd innovation of modern times. If the gas was foul, reeking with sulphur and destroying the silver and bright metal work in the customers' houses, he "couldn't help that." At holiday times, and a few occasions thrown in, for which no apparent reason was forthcoming, he went "on the drunk" for a few days, and during those times some little playful variations on the dreary sameness of everyday routine, such as jumping all the lights out by turning off one holder before turning on the other, were not uncommon occurrences. While quite willing to discuss the working at any other place, he resented any suggestion as to his own practice, apparently having a strong impression that all the wisdom necessary for dealing with his home works was centered in himself, and that any suggestion as to improvement was a reflection on his own ability. With all his peculiarities he was good humored, scrupulously courteous to those in authority over him—another trait of the British working man that is now nearly extinct—strictly honest in respect to any dealings on behalf of the company, and could be trusted to sell out bushels of coke and gallons of tar and religiously hand over every halfpenny received, and, on the whole, enjoyed the esteem of all who knew him. How he acquired his practical knowledge was usually a matter of mystery about which he was reticent. Sometimes he was a laborer called in to help in the construction of the gas works, or perhaps he had been employed by a constructing engineer for a short time. But now, even the title—for he was always spoken of as a "stoker"—is getting as rare as the class of man it represented.

The Dryness of Steam.

Prof. Osborne Reynolds, LL.D., F.R.S., in the course of a paper read before the Manchester Literary and Philosophical Society, much of which was devoted to a consideration of "methods for determining the dryness of saturated steam and the condition of steam gas," said that in certain recent attempts to ascertain the proportion of steam and water in the fluid which enters a steam engine, by means of what is called the wire-drawing calorimeter, the published results show that there remains from 0 to 5 per cent. by weight of water in the steam, after it has been drained by gravitation, in the same manner as the steam on which Regnault's experiments were made. This has necessarily excited great interest in steam engineering, and is naturally welcome, as it apparently brings the performance of the engines by so much nearer perfection. Although the results of these recent experiments appear to show the condition of dry saturated steam to be other than that on which Regnault's experiments were made, and from which the present steam tables have been calculated, still these tables have been used in deducing the percentage of water latent in the steam. Whereas, if the latent water exists, it must have existed in the steam used by Regnault, and the steam tables must also be subject to identical corrections; and, consequently, the percentage of theoretical performance of steam engines would be unchanged.

It is then pointed out that, in the reduction of such of these results as have been published, use has been made of Regnault's determination of the specific heat at constant pressure of steam gas (0.48) in a manner which is not consistent with the theory of thermodynamics. Thus, in Rankine's notation, S_1 is the weight of steam per pound of fluid, and H_1 the total heat per pound from 0° C. to T_1°, h_1 the heat required to raise water per pound, and H_2, h_2, T_2 the corresponding values for saturated steam at the pressure after wire drawing, and Ts° the observed temperature after wire drawing.

The notation assumed for the equation of heat, neglecting incidental losses, is—

$$S_1 (H_1 - h_1) + h_1 = H_2 + 0.48 (Ts° - T_2°) \ldots\ldots (1)$$

Whereas, it has been proved by Rankine that the thermodynamic expression for the total heat in superheated steam at Ts° C., provided it has reached the condition of steam gas, to which the 0.48 only applies, is—

$$C_1 + 0.48 (Ts° - T_0°).$$

C_1 being a constant, depends only on the temperature of the water (T_0°) from which the steam is produced, the value of which from 0° C. is 606.7, approximately, as deduced by Rankine.

Using Regnault's formula for H_2, the right member of equation (1) becomes—

$$606.5 + .305\, T_2° + 0.48 (Ts° - T_2°),$$

while the value by the thermodynamic formula is—

$$606.7 + 0.48\, Ts°,$$

which gives as the excess of heat over that assumed—

$$2 + 0.175\, T_2°.$$

This excess, if T_2 were 100° C., is 17.7 thermal units, and if the initial steam pressure were 200 pounds above the atmosphere, the latent heat being 467.5 thermal units, the percentage of water it would evaporate, at boiling point, is—

$$\frac{177}{4,675} = 3.8 \text{ per cent.},$$

which is about as much as needs to be accounted for. It is also shown that, in order to render Rankine's formula applicable to wire-drawing experiments, it is necessary that the wire-drawing should be continued till the steam is gaseous, whence arises the difficulty of securing that this state has been reached. This, however, may be secured by lowering the pressure gradually after wire-drawing, and so increasing the extent of wire-drawing while observing the temperature (Ts°), which, after falling, will gradually become constant as the wire drawing increases, and, when constant, will be a definite indication of this gaseous state.

The necessary conditions to insuring accuracy are then considered, and, in conclusion, it is stated that a research to verify these conclusions has been commenced by Mr. J. H. Grindley, B.Sc., in the engineering laboratory of Owens College, Manchester, England.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. Geo. W. Wheeler, formerly Chief Engineer of the Napa City (Cal.) State Insane Asylum, has been elected President and General Manager of the Oklahoma Gas and Electric Company, of Oklahoma City, Oklahoma.

The reduction of the gas rate in New Rochelle, N. Y., to $1.60 per 1,000 cubic feet, went into effect on the 1st inst.

At the annual meeting of the New Haven (Conn.) Gas Light Company the officers chosen were: Directors, T. Atwater Barnes, Pierce N. Welch, Robert A. Brown, George D. Watrous, Andrew W. De Forest, Charles R. Ingersoll, George J. Brush and Francis Wayland; President, Andrew W. De Forest; Vice President, Pierce N. Welch; Secretary, Gardner Morse; Treasurer, Isaac J. Wild.

According to a decision of the United States Circuit Court of Appeals made public some days ago, natural gas is declared to be a mineral for all the purposes of the statutes and customs laws of the United States. The Court affirms the decision of the United States Circuit Court of this district, which affirmed a decision of the Board of General Appraisers declaring that gas piped from Shirkstown, Canada, into Buffalo, N. Y., was not subject to duty, as it comes within the definition of "crude minerals."

Papers incorporating the Larchmont (N. Y.) Gas Company have been filed by Messrs. William Carpender, of New York, Francis Crawley, of Mount Vernon, N. Y., Ralph Woodward, of New Rochelle, N. Y., George G. Ramsdell, of Wayne, Pa., and Morris W. Stroud, of Villanova, Pa. The Company, which is capitalized in $100,000, proposes to supply gas in the towns of Larchmont, Mamaroneck and New Rochelle, N. Y., and is controlled by the American Gas Company, of Philadelphia, Pa., which Company now supplies gas in New Rochelle through its ownership and operation of the plant formerly controlled by the New Rochelle Gas and Fuel Company.

Mr. Sinclair Mainland has resigned from the service of the Oshkosh (Wis.) Gas Light Company to undertake the management of the properties of the Green Bay and Fort Howard (Wis.) Gas and Electric Light Company.

Mr. William V. Reynolds, who was President of the Saratoga (N. Y.) Gas and Electric Light Company, from 1890 to the close of November, 1893, when Mr. Lafayette B. Gleason was made Receiver of the Company, died at the Grand Hotel, New York, on the evening of the 7th inst. Deceased, who was in his 52d year, was at one time well known in railroad circles, from his connection with the Boston, Hoosac Tunnel and Western Railroad. The funeral services were held in Reynolds Corners, N. Y., on Sunday, Jan. 10th.

At the annual meeting of the Consolidated Gas and Electric Company, of Batavia, N. Y., the Directors chosen were: S. D. Purdy and E. D. McNair, of Warsaw, N. Y., and John P. Casey, Owen C. Steele, and R. L. Kinsey, of Batavia. The only change in the Board was in the naming of Mr. McNair to succeed Mr. Charles H. Caldwell, but

that change was important enough to foreshadow an almost complete reorganization of the Company's executive management; for when the Directors subsequently met to reorganize for the year, the following officers were chosen: President, S. D. Purdy; Vice-President, E. D. McNair; Secretary and General Manager, R. L. Kinsey; Treasurer, John Thomas. Mr. Kinsey will be the active man of the Company, and the real significance of the action of the Board of Directors is the determination to put the gas supply of Batavia in better shape than has obtained there for the past year or so.

AT the annual meeting of the Omaha (Neb.) Company, the following officers were chosen: Directors, George E. Barker, F. Murphy and B. D. Wood, of Omaha, and Samuel T. Bodine and Randall T. Morgan; President, Frank Murphy; Vice-President and Secretary, George E. Barker; Treasurer and General Superintendent, Isaac Battin.

WE regret to report the death, on the evening of the 4th inst., of Mr. George P. Dickerson, who for many years served the Nothampton (Mass.) Gas Light Company as Secretary and Treasurer. Deceased, who was in his 74th year, was born in Northampton 74 years ago, and, with the exception of a short space of time, spent in Brooklyn, N. Y., his business career was identified with his birthplace. The correspondent who informed us of Mr. Dickerson's death inclosed the following lines from an obituary mention of Mr. Dickerson, that was printed in the Northampton *Gazette:* "He was a man of sturdy integrity; faithful to every duty and trust. He was in his private affairs careful, prudent and economical. To the younger generation of the town he always appeared as one of the venerable fathers to whom all looked up with respect and honor."

THE Welsbach Light Company has filed a suit in the United States Circuit Court, against L. A. Holmes, of New Haven, Conn., plaintiff claiming that it has been damaged in the sum of $5,000, through defendant's manufacture and sale of a burner which is a direct infringement of the Welsbach Incandescent gas burner.

THE Peoples Gas and Electric Company, of Stoneham, Mass., has been formed to take over and operate the plant and business in Reading and Stoneham, of the Citizens Gas Light Company, of Reading, South Reading and Stoneham. The incorporators have applied to the Board of Gas and Electric Light Commissioners for permission to issue new stock of the par value of $45,000.

ACCORDING to the report of the Gas Inspector for Minneapolis, Minn., the average illuminating power of the gas supplied by the Minneapolis Gas Light Company during 1896 equalled 24.83 candles. The average consumption of gas in the burners of the public street lamps was 5.98 cubic feet.

THE Boston *Traveller* says that the output of gas by the several Companies comprising the Bay State group, as well as that of the Brookline Gas Light Company, for the month of December, 1896, aggregated 271,178,000 cubic feet as against 267,506,000 cubic feet for the corresponding period of last year, an increase of 3,672,000 cubic feet. For the entire year the production was 2,405,116,000 cubic feet, as against 2,184,439,000 cubic feet in 1895, a gain of 220,677,000 cubic feet. Exclusive of the Brookline Company's production the Bay State Companies produced 190,348,000 cubic feet in December, or a gain of 9,293,000 cubic feet, and for the year, 1,642,685,000 cubic feet, a gain of 122,326,000 cubic feet. The gain of the Brookline Company in 1896 over 1895, amounted to 98,351,000 cubic feet.

A CORRESPONDENT at Detroit, Mich., forwards the following, under date of the 7th inst.: "The case of the Detroit Gas Company vs. The Moreton Truck Company, was decided yesterday by the Supreme Court, in favor of the Gas Company, which also means that the decision by the lower court was reversed. The Truck Company refused to pay a bill for furnishing 60 feet of pipe and the cost of labor to connect the same to a meter in its stables, whereupon the Gas Company replevined the meter. The Circuit Court decided that the title to the meter rested with the Gas Company, but the right of possession remained with the Truck Company, and damages were assessed to the latter. The Court (opinion of Judge Grant) on appeal assumes that the Truck Company was liable for the reasonable cost of putting in the service, and it is conceded that as the Gas Company owns the meter, it may remove the same for non-payment of bills for gas rendered—in fact the lower court so instructed the jury. The Supreme Court says the connection was made for the sole purpose of furnishing gas, and that as the agreement to do these things and to furnish gas were parts of the same contract, failure to comply with one provision of the contract allowed the Gas Company to remove the meter. Accordingly, the Gas Company was granted the right to maintain the action of replevin.

AT the annual meeting of the Consumers Gas Company, of Woodbury, N. J., the following officers were elected: Directors, Messrs. H. C. Clark, G. G. Green, G. W. Curtis, H. H. Clark, A. J. Rice, C. R. Ogden, C. C. Jessup, Arthur Starr, Lewis Starr, E. T. Bradway, J. R. Newton, M. W. Newton and H. S. Talman; President, H. C. Clark; Vice-President, G. G. Green; Secretary and Treasurer, C. W. Starr.

IT seems that the movement to establish an opposition gas works at Amsterdam, N. Y., has considerable vitality, for the announcement is made that the Citizens Gas Light and Fuel Company, to operate in the place named, has been incorporated, with a capital of $50,000. The Directors are: Dr. R. G. Johnson, and Messrs. Charles D. Austin, Ernest Kurlbaum, Bernard P. Machold and Wm. J. Currie. The executive management is: President, Dr. R. G. Johnson; Treasurer, Bernard P. Machold; Secretary, Charles D. Austin. The Company's petition to the Amsterdam Common Council will be considered on Tuesday, February 2nd.

THE following is the text of the notice, issued at the instance of the the officers of the Wilmington (Del.) Coal Gas Company, under date of the 5th inst. The notice goes to show that the business like methods that have prevailed in the management of the Company, under the careful direction of President Betts in its offices and of Engineer Curley at the works, are to continue in carrying on the Company in the favor of its customers and of returning fair gains to its proprietors. The notice reads: "The Wilmington Coal Gas Company announces to its patrons, with great satisfaction, a reduction in the price of gas, and hopes that the reduced price will encourage its greater use for illuminating, heating and cooking, as well as for power. It has been the aim of the Company, since the last reduction in 1891, to improve the manufacture and distribution of its gas and thereby to increase the sales, so that a reduction could be made at the earliest possible day. That time seems now to be nearly reached, and the Directors have this day ordered, that for all gas sold by meter, on and after January first, 1897, the price shall be $1.10 per 1,000 feet, subject to a discount of 10 cents per 1,000 on all bills paid within 10 days of their delivery; and that upon all bills unpaid upon the expiration of the said 10 days grace, a reduction of 8 cents per 1,000 feet be made, *provided*, payment be made during the current month of first delivery."

AT a special meeting of the Board of Directors of the Hornell Gas Light Company, of Hornellsville, N. Y., held on the 4th inst., the resignation of Mr. H.W. Booth as Secretary was accepted, and Mr. T.W. Summers was elected to fill the vacancy. On motion the following resolutions were carried unanimously:

"*Whereas*, The Directors of the Hornell Gas Light Company have received the resignation of Mr. W. H. Booth as Secretary, be it

"*Resolved*, That his resignation be accepted, with an expression of our goodwill and esteem, with regret that he cannot find it as profitable to remain with us as to do otherwise, and with the acknowledgment of his business integrity and valued services. We congratulate Mr. Booth upon his advancement to a more profitable field of labor, and the Security Mutual Life Insurance Company upon securing the services of one whom we have always found faithful, energetic and obliging. Hoping that the relations between them will always be as pleasant as those between him and ourselves have been,

"*Resolved*, That a copy of these resolutions be furnished Mr. Booth, and given to the papers for publication."

THE election for Directors in the Chambersburg (Pa.) Gas Company resulted as follows: Samuel M. Linn, Augustus Duncan, Isaac Stone, B. C. Ross, W. U. Brewer, Frank Lindsay and Tench McDowell.

THE following should be read in connection with our mention of a week ago respecting the formation of the Richmond (Va.) Gas Company, the projectors of which are desirous of taking over the gas supply of Richmond:

To the Honorable Council of the City of Richmond—The undersigned, your petitioner, the Richmond Gas Company, a corporation chartered under the laws of the State of Virginia, and being duly authorized thereto, respectfully makes this its petition to your honorable body, praying for a lease of the gas works of the city of Richmond, upon such conditions, restrictions and limitations as may be hereafter

set forth and agreed upon between your honorable body and this petitioner.

In consideration of the lease asked for, of the gas works of the city, and the rights and privileges thereto appertaining and belonging, and the gas privileges of the city for a term of 30 years, your petitioner proposes during the term of the said lease:

First. To furnish to the city gas, free of cost at such places along the mains and in such quantities as may be necessary for the lighting of the city buildings and its streets; provided, that the amount of gas so delivered shall not exceed 30,000,000 cubic feet in any one year.

Second. To pay to the city the sum of $40,000 per annum during the continuance of said lease, payable in four equal quarterly payments of $10,000 each, the first payment to be made three months from date of possesion by petitioner, said sum to be in lieu of all taxes and assessments, dues and water rents to the city.

Third. To furnish and deliver to private consumers gas at not exceeding $1 per 1,000 cubic feet.

Fourth. To furnish gas to both the city and to private consumers of not less than 20-candle power (photometric test) and free from sulphureted hydrogen.

Fifth. To keep the property leased in good and substantial repair, and surrender the same at the end of said term in as good and serviceable condition as when received.

Sixth. To make such extensions and improvements in the works, mains, etc., as may be found necessary in properly supplying gas to consumers, the right to make such extensions and improvements to be given in the lease, or by proper ordinances, provided that if at the expiration of the lease the value of the plant shall be in excess of its value at the beginning of the term, the city shall pay to your petitioners such excess in value.

Seventh. To give a bond in such reasonable penalty as your honorable body may determine, with approved surety, for the faithful performance of the covenant of said lease.—Respectfully submitted, Richmond Gas Company. PHILIP B. SHIELD, Attorney.

WHEN the petition had been read, Mr. Wallerstein inquired whether it was within the province of the Council to lease or to sell the gas works, and President Caskie replied that, according to the Code of Virginia, an Act approved February 25, 1892, specifically directs that the Richmond city gas works shall not be sold or leased without such proposed sale or lease having been passed on by the vote of the legally qualified voters of Richmond. After some further discussion, the petition was, on motion of Mr. Bloomberg, referred for consideration to the Committee on Finance and Light.

THE plant of the Johnstown and Gloversville (N. Y.) Gas Company, which is operated by the United Gas Improvement Company, of Philadelphia, will probably be rebuilt this spring. It is possible that the new plant will be located in Gloversville, instead of Johnstown, as at present.

MR. E. STEIN and associates have applied to the City Council of Waukegan, Ills., for a franchise to operate a gas works in that city. The main features of the ordinance are: The city to grant the applicants, their heirs or assigns, the right to lay and maintain pipes in the streets under the jurisdiction of the Council; the Company to begin work of construction and pipe laying within six months after the passage of the ordinance, and to commence the supply of gas within 12 months. The gas rates named were: Monthly consumption of 2,000 feet or less, $1.40 per 1,000; 2,000 to 6,000, $1.35; 6,000 to 10,000 feet, $1.30; 10,000 feet or more, $1.25; prompt payment (within 10 days) to entitle the user to a rebate of 10 cents per 1,000. It was stipulated that the gas should have an illuminating value of 20 candles, but that if the Company elected to furnish gas of 30-candle power or over, it might charge proportionately more than the figures in the rate schedule above given. The Company agreed to supply lights for the streets on a basis of a charge of $25 per lamp per annum, the lanterns to carry 5-foot burners, the lighting schedule to be arranged on a basis of 3,850 hours per anannum. A bond of $5,000 was also promised.

MR. CABOT informs us that the manufactory and office headquarters for his specialties in trays for gas works have been removed to 553 West 33d street, this city. The removal was made from their former location on 11th avenue solely because the new premises afford larger and more convenient quarters. In spite of the "dull times in general" during 1896, Mr. Cabot has not much to complain of, for the books show that the business done by him in trays for gas works in the year just closed was double that recorded for 1895. Orders for the goods were received from 96 separate gas companies. The best part of it all, however, is that Mr. Cabot, in closing his letter to us, says, "From inquiries coming in, it looks as if we shall do better this year."

AT the annual meeting of the Lebanon (Pa.) Gas Company the officers chosen were: Board of Managers, Anthony Aurentz, Rudolph Behm, Theo. D. Greenawalt, Charles H. Killinger, John W. Mish, George H. Reinoehl and L. E. Weimer; President, George H. Reinoehl; Secretary, John W. Mish. A noteworthy fact in connection with this election is that it marks the forty-second consecutive naming of Major John W. Mish to the position of Secretary.

THE following Directors have been elected to manage the properties of the Washington Gas Company and the Washington Electric Light and Power Company, of Washington, Pa., for the ensuing year: W. P. Hastings, H. P. Chambers, A. G. Hopper, Alex. Reed, O. D. Bleakley, J. L. Thistle and J. S. Simonton.

THE following notice was printed in the Worcester (Mass.) *Spy* of recent date: "The Directors of the Worcester Gas Light Company, after a conference with Mr. Forrest G. Barker, Chairman of the Board of Gas and Electric Light Commissioners, at his suggestion, have decided to make the net price of gas furnished by the Company $1.15 per 1,000 cubic feet, on and after February 1, 1897, on all bills paid on or before the 15th day of the month in which they are presented.—CHAS. D. LAMSON, President."

THE *Spy*, in commenting upon the notice, said: "This action of the Gas Company will be hailed with satisfaction by every business man and private consumer in the city. The price is now $1.40 per 1,000 cubic feet, with a reduction of 15 cents per 1,000 for prompt payment, which makes the net price $1.25 per 1,000. The production of the Company amounts to some 200,000,000 cubic feet annually, and the reduction in price will lop off $20,000 from the receipts for the year. The decision was a voluntary one on the part of the Directors, and no request or petition for the reduction was made."

THESE Directors have been chosen by the Hackensack (N. J.) Gas and Electric Company: George W. Conklin, F. B. Poor, William M. Johnson, E. A. Pearce, D. St. John, Lemuel Lozier.

THE new incandescent electric lighting plant of the Raleigh (N. C.) Gas Company is in operation.

THE Detroit (Mich.) Gas Company has completed an arrangement with the American Express Company whereby gas consumers who do not wish to settle their accounts at the main office of the Gas Company may pay the same at any of the local branch offices of the Express Company—these branches number several score, and are to be found in every part of the city, and short distances from each other. The fees are about like these: For bills of $5 and under, 5 cents; over $5, but under $10, 8 cents; proportionately, for bills of $10 and over.

Roller Bearings in Steam Engines.

Ever since ball bearings and roller bearings have been in use the thoughts of mechanics have been directed to the immense advantages which would attend their successful application to our most common prime mover—the steam engine. Visions of vanished oil bills and of decreased wear and tear expense are perhaps rightfully associated with such a scheme, but the high pressures, and especially the rapid reversals of direction of pressure, militate against success, and he would be a bold engineer who would to-day contract for a large reciprocating steam engine equipped throughout with bearings of the type we are considering.

The bearings themselves are rapidly nearing perfection, both in design and in construction; and not in quality only is the improvement manifest, but in decreased cost also. Any considerable increase in the employment of roller bearings would mean the opening up of new factories and the extension of others to meet the growing demand, and American machinists would have enlarged opportunities at high class work. The manufacture of lubricating oils from petroleum would receive a setback, but there would be all the more of the crude oil available for liquid fuel and oil gas engines. The small motor of the future may use oil in its cylinder, but not on its bearings.

But, if the ordinary steam engine of to-day is not adapted for the immediate fitting of rollers to its principal journals and pins, possibly some simple modification of the engine may be found which will ena-

(*Continued on page* 93.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

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WESTERN GAS ASSOCIATION.
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MONDAY, JAN. 18, 1897.

(*Continued from page 92.*)

ble it to utilize the rollers without involving any loss of efficiency from a thermodynamic standpoint. Not a few successful forms of single acting steam engines are in use, and the constancy of the direction of pressure in these engines would seem to render them fit subjects for experiment. It is not improbable that in the machine shop and factory of the future lubricating oil will be found only in the sample case of the superintendent.

The Market for Gas Securities.

It has been said that the hour which is darkest is the hour before dawn, which old saw seems particularly well adapted for application to the gas situation in New York State. A week before the assembling of the Legislature he indeed would be a brave predictor who announced that the Gas Companies of New York City at any rate would be obliged to sell gas at least at $1 per 1,000, through legislative enactment, some time during the current year. Now, however, that the Legislature is in session, and even though several bills have been introduced, one of which seeks to put the selling rate in New York at 75 cents per 1,000, to regulate rates in New York and other cities, the outlook for the Companies is not near so dark as it was during the last week of December.

The real truth about the clamor over cheaper gas is that it did not really begin with the consumers, but rather with one or two newspapers, whose chief claim to journalistic prominence is their employment of "ladylike" reporters and "magnetic" editors. The reporters and the editors were attracted to the subject of gas because of the attempt of the Consumers Fuel Gas Company to secure a franchise, the main bait of the concern being the fishy promise to sell gas at less than 50 cents per 1,000, and the newspapers thereupon decided that current gas rates in New York were too high. They, however, seemingly overlooked the fact that sand is cheaper than sugar, and as sand would be to sugar for the sweetening of a pie, so would the fuel gas which was to be supplied compare with the gas now supplied in the instance of cooking, lighting, etc. However, despite the raft of bills already on hand, it looks that no sweeping change will be made, although beyond a doubt some sensible, practical measure looking to a gradual reduction over a term of years will be passed. A notable bill was presented in the Assembly yesterday, by Mr. Dudley, providing for a State Commission of three members, whose duty it shall be to oversee the gas, electric lighting and water supply interests of the State.

We have not received the text of the measure, but our information is to the effect that it is quite a sensible arrangement. The Assembly Committee on Gas, Water and Electricity (Goodsell, Orange, Chairman; Braun, of Erie; Cole, of Wyoming; Taylor, of Oswego; E. L. Schmidt, of Montgomery; Graves, of Oneida; Springer, of Herkimer; Winne, of Schenectady; Weitner, of Rockland; Soper and McKeown, of Kings; Corrigan, of New York, and Lennon, of Kings) looks to be a fairly constituted body. Take it all in all, the outlook for fair play seems assured, and holders of city shares are accordingly in a better frame of mind. The quotations show how much better the feeling is.

The features in out-of-town shares were a sharp advance in Chicago, and quite a jump in Brooklyn Union. Other shares show no particular change.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

JAN. 18.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	143⅛	144
Central	500,000	50	175	205
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	190	195
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	215	225
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	85	..
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	42	42¾
Preferred	2,000,000	100	72	73
Bonds 1st 5's	3,500,000	1,000	105	106
" 1st Con. 5's	1,500,000	..	94	96
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	80	81½
Preferred	5,000,000	100	100	103
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109½	..
Yonkers	299,650	50	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	88	90
" " Bonds (5's)	15 000,000	1,000	106¾	107
Bay State	5,000,000	50	11⅝	12
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000		76
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	77⅛	77¾
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds	7,650,000	1,000	94	94¼
Columbus	1,089,000	..	68	70
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	70	75
" Bonds	600,000	1,000	100	102
Cincinnati G. & C. Co.	7,000,000	100	190x	200
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	.	.
Consolidated, Baltimore	1,000,000	100	61¼	61½
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	19	25
" Con. Bonds	4,312,000	..	..	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	82	86
" Bonds	2,000,000	..	85	90
Hartford	750,000	25	.	145
Indianapolis	2,000,000	..	130	135
" Bonds, 6's	2,650,000	..	103	105
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	84	88
Bonds	1,000,000	1,000	85	90
Louisville	2,570,000	50	.	..
Laclede, St. Louis	7,500,000	100	23	23¼
Preferred	2,500,000	100	75	80
Bonds	9,084,400	1,000	93½	94
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	98	98
Bonds, 6's	4,000,000	.	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53¼	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	97¾	98¼
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	..	88	90
Syracuse, N. Y.	500,000	25		..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	63	65
Bonds, 5's	3,556,000		90	93
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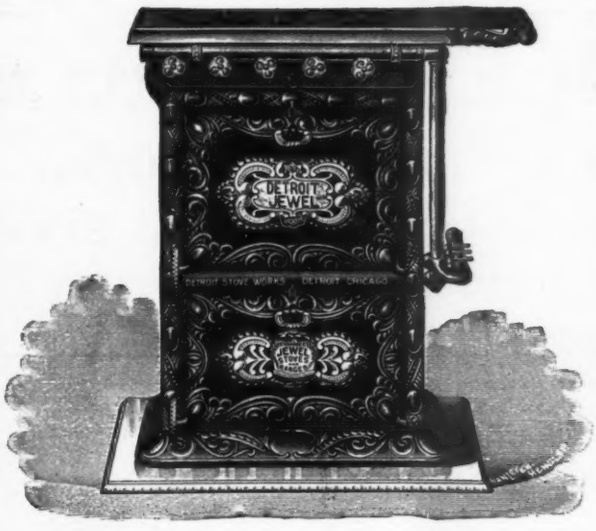

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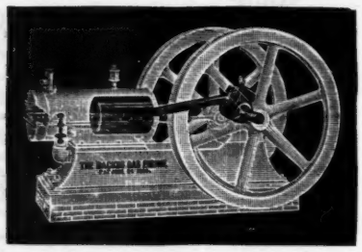
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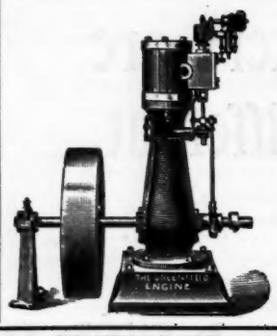
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Steam Engine Works.
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Sizes from 3 to 75 Horse Power.
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THE GREATEST IMPROVEMENT IN GAS LIGHTING
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WILDER'S VOLUMETRIC GOVERNORS.
They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.
WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.
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PACIFIC COAST AGENTS FOR **THE KEYSTONE METER CO.**
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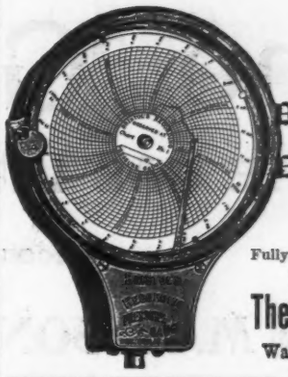

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TIP CARS for Carrying Ashes,
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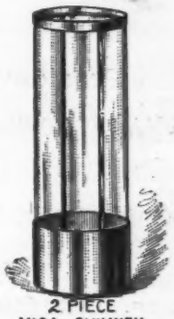

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ALSO UNDERTAKES ALL KINDS OF CONSTRUCTION WORK.

Especially the Installation or Extension of Plants for the Manufacture of Gas from Caking Coal.

The attention of Gas Managers is particularly called to the many improvements in this method of manufacture instituted during the past fifteen years, and the extremely low cost at present of Coal Gas.

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Charles E. Judson, Chicago.
Gen. James Jourdan, Brooklyn.
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Albion L. Page, New York.
Thomas F. Rowland, New York.
Frank Tilford, New York.
Prof. R. H. Thurston, Ithaca N. Y.
Eugene Vanderpool, Newark, N. J.
Capt. Wm. H. White, New York.
Dr. Wm. H. Wahl, Philadelphia.
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The Gas Associations have Appointed the Following Representatives:

W. M. EATON, Michigan Gas Asso. **J. A. BRITTON,** Pacific Coast Gas Asso. **IRVIN BUTTERWORTH,** Ohio Gas Light Asso. **GEO. T. THOMPSON,** Western Gas Asso.

C. J. R. HUMPHREYS, American Gas Lt. Asso. **C. H. NETTLETON, New England Asso. of Gas Engineers.**

Every indication points to the attendance of gas men from near by as well as from the most remote sections of the country. Arrangements are now under way for providing hotel and railway facilities for members of the gas fraternity who may wish to visit New York during the Exposition.

Several New York hotels have offered special rates.

Full particulars on these points will be given very shortly.

The Historical Exhibit will embrace many articles of surpassing interest. A celebrated collection of ancient lamps and lighting appliances, consisting of several hundred rare specimens never exhibited outside the great institution in which the collection is now lodged, is promised.

GAS MEN'S NIGHT.

The Ohio Gas Light Association will hold its annual meeting in this city during the Gas Exposition. Date, February 3 and 4. The management has designated Wednesday evening, February 3, as **Gas Men's Night.** A programme will be made up covering this feature that will appeal to all as befitting the occasion.

THE TIFFANY GAS TOWER,

With its Myriad of Lights and Beautiful Decorative Effects. Worth a Thousand Mile Journey to See.

INJUNCTION ISSUED AGAINST INFRINGERS.

On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES. } IN EQUITY.

The President of the United States,

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

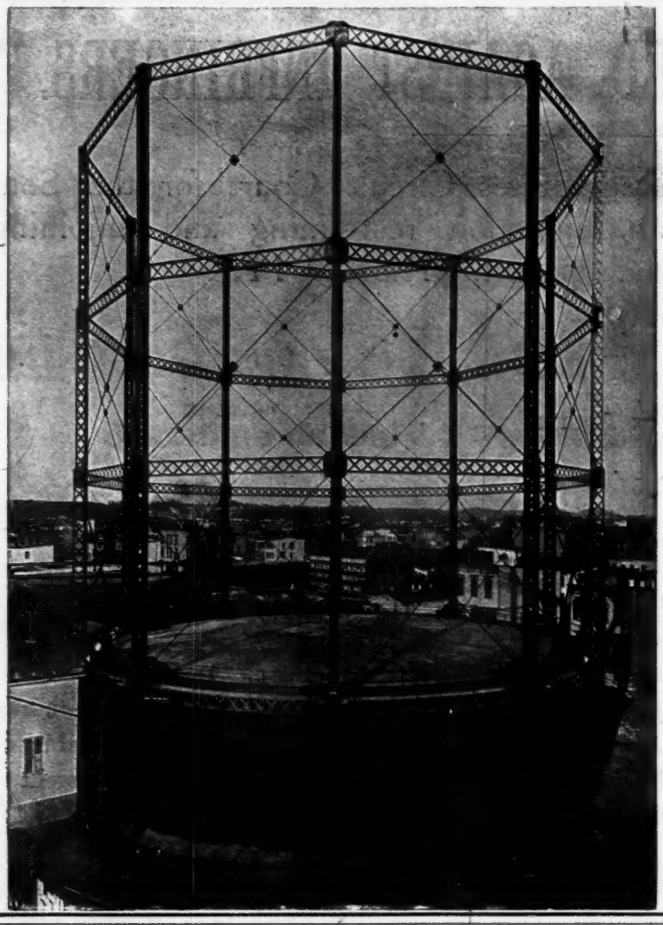
(SEAL) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

WELSBACH LIGHT COMPANY.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

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AND ALL PARTS OF

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Special Trays for Iron Sponge or Oxide of Iron,

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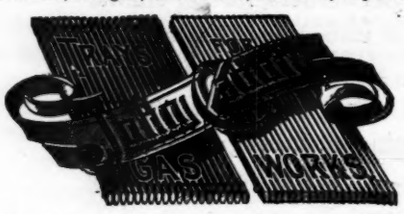

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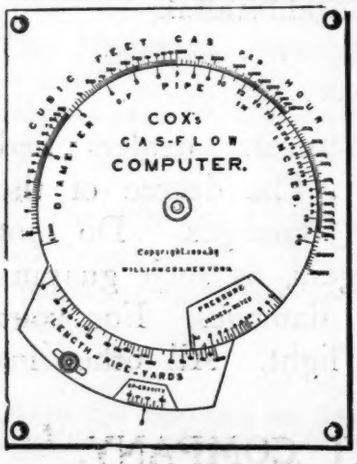

Cox's Gas Flow Computer.

1. It gives at a glance the discharge of gas from pipes 1 to 48 inches in diameter and 10 to 10,000 yds. long, for any pressure from 0.01 to 10.0 inches of water, and any specific gravity from 0.40 to 1.00.
2. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is at once seen.
3. When the required discharge and the length of pipe are given, the pressure corresponding to any diameter is at once found.
4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.

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We believe it. For buyers of Gas Stoves are constantly coming our way.
They can't help it. The people know what they want, and when they ask for

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They can't be induced to take any other make. Splendid results from our New Burners.
Lots of inquiries. It's taking—it's so simple. Never burns yellow. Don't pop back.
You can take it apart with your fingers. The same perfection in everything we make.

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Coal and Water Gas Plants,

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Recuperative Furnaces, Washers, Condensers, Purifiers, Purifying Machines.

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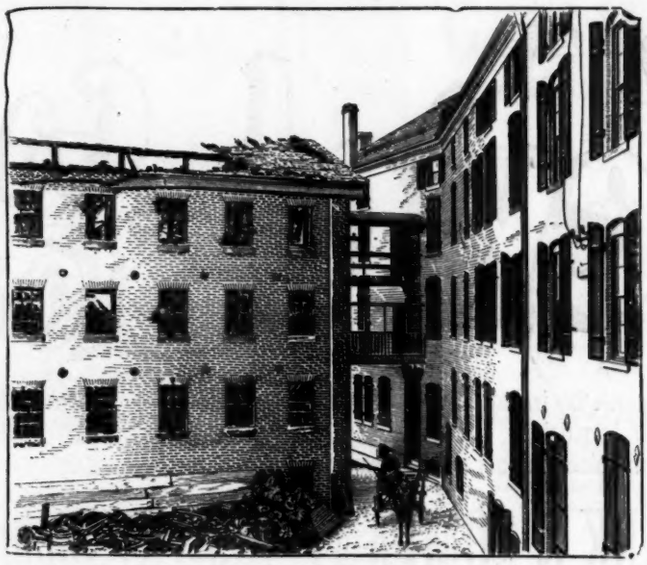

The above illustration is taken direct from a photograph, and shows how our Corrugated Iron Fireproof Shutters prevented the destruction of the Russell & Erwin plant, at New Britain, Conn., when one building was entirely destroyed by fire during the early part of March, 1896. The interior of the building on the left, as shown, was completely burned out. The building on the right is located across a narrow driveway from the main building, and yet, notwithstanding the intense heat and close proximity of the two buildings, our Corrugated Iron Fireproof Shutters prevented the fire from spreading.

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THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS.

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ESTABLISHED 1834. INCORPORATED 1863.

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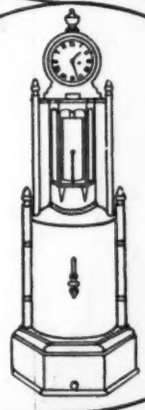

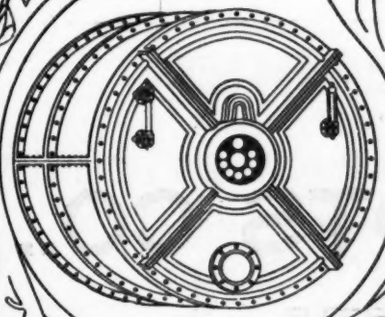

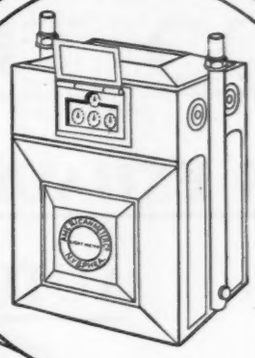

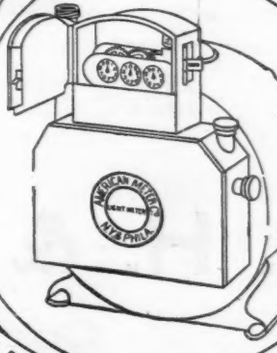

PUBLIC LIGHTING TABLE.

FEBRUARY, 1897.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Mon.	1	5.50 PM NM	6.10 AM	5.05	6.15
Tue.	2	5.50	6.10	5.05	6.15
Wed.	3	5 50	6.10	5.05	6.15
Thu.	4	5.50	6.10	5.05	6.15
Fri.	5	5.50	6.10	5.10	6.10
Sat.	6	9.40	6.10	5.10	6.10
Sun.	7	10.40	6.00	5.10	6.10
Mon.	8	11.40	6.00	5.10	6.10
Tue.	9	12.40 AM FQ	6.00	5.10	6.10
Wed.	10	1.40	6.00	5.10	6.10
Thu.	11	2.40	6.00	5.10	6.10
Fri.	12	3.30	6.00	5.20	5.55
Sat.	13	4.10	6.00	5.20	5.55
Sun.	14	4.50	5.50	5.20	5.55
Mon.	15	No L.	No L.	5.20	5.55
Tue.	16	No L. FM	No L.	5.20	5.55
Wed.	17	No L.	No L.	5.20	5.55
Thu.	18	6.10 PM	8.30 PM	5.20	5.55
Fri.	19	6.10	9.40	5.30	5.55
Sat.	20	6.10	10.50	5.30	5.55
Sun.	21	6.20	12.10 AM	5.30	5.55
Mon.	22	6.20	1.30	5.30	5.55
Tue.	23	6.20 LQ	2.40	5.30	5.55
Wed.	24	6.20	3.50	5.30	5.55
Thu.	25	6.20	4.40	5.30	5.55
Fri.	26	6.20	5.30	5.30	5.45
Sat.	27	6.20	5.30	5.30	5.45
Sun.	28	6.20	5.30	5.30	5.45

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45

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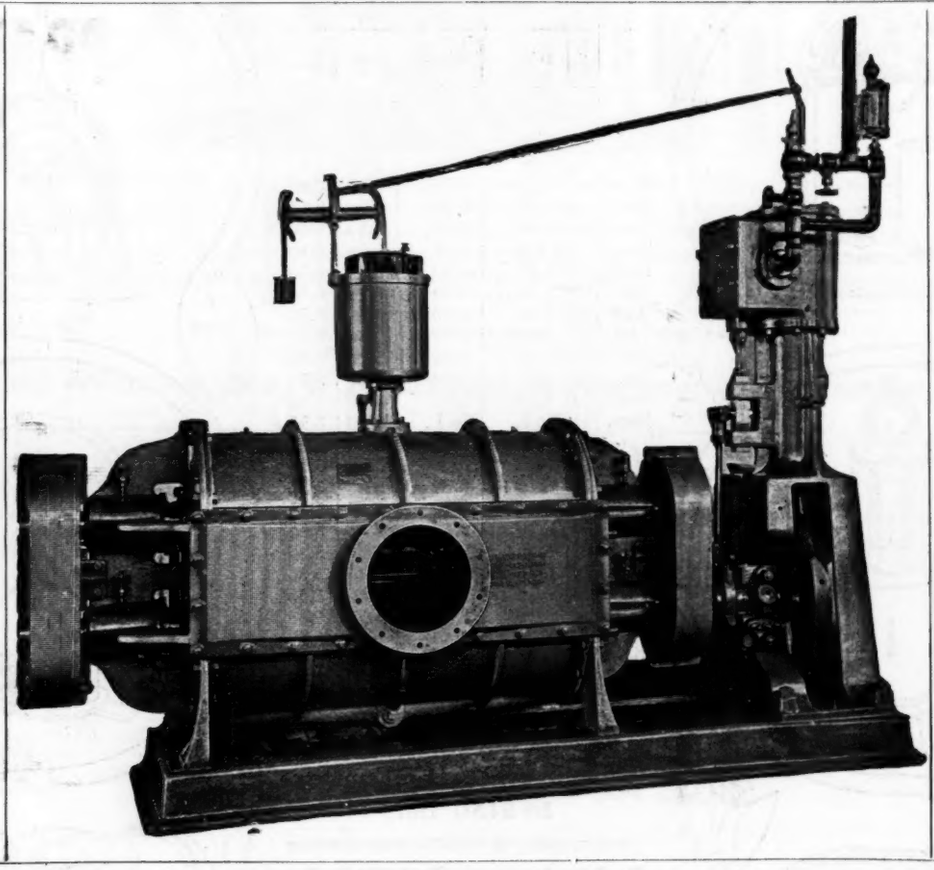
Connersville, Ind.

GAS EXHAUSTERS. BYE-PASS VALVES.

AUTOMATIC GAS GOVERNORS.

GAS VALVES. PIPE FITTINGS.

New Design of Direct Connected Engine and Exhauster on Same Bedplate.



This Design is Used for all Exhausters from No. 7 to No. 10, Inclusive.

Write for Illustrated Catalogue.
Estimates submitted on application.

P. H. & F. M. ROOTS CO.,

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New York Office, 109 Liberty Street. J. B. STEWART. Manager.

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DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

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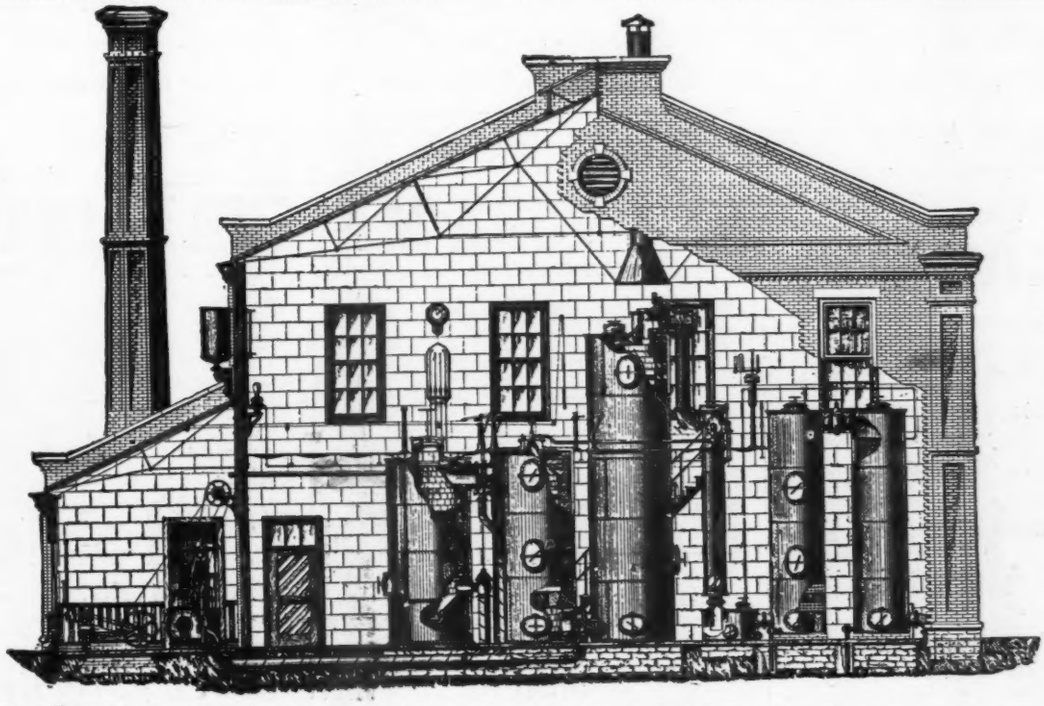
THE STANDARD LOWE WATER GAS APPARATUS.



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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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ENGINEERS and BUILDERS,

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Water Gas Apparatus . . .

Improved Double Superheater Settings,
Improved Single Superheater Settings,
Special Designs for Small Works.

Our apparatus is designed to use any grades of Oils or Naphthas, Gas House or Oven Coke, or Anthracite Coal. Results are Guaranteed.

Coal Gas Apparatus . . .

Agents and Builders. { For FRED. BREDEL—Washers and Purifying System, Mouthpieces and Bench Castings,
For GEO. SHEPARD PAGE'S SONS—Walker Ammonia Concentrators and Sulphate Stills,
Walker Patent Mouthpieces.

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Purifiers, Condensers, Scrubbers, Street Main Specials, Iron Roofs, Iron Floors, Oxide Elevators and Conveyer Machinery.

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MANUFACTURERS OF

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Double and Single Gate, ¾ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

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ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

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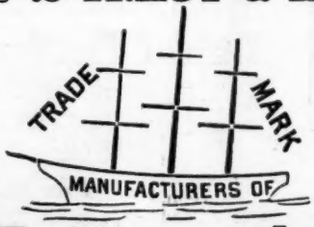

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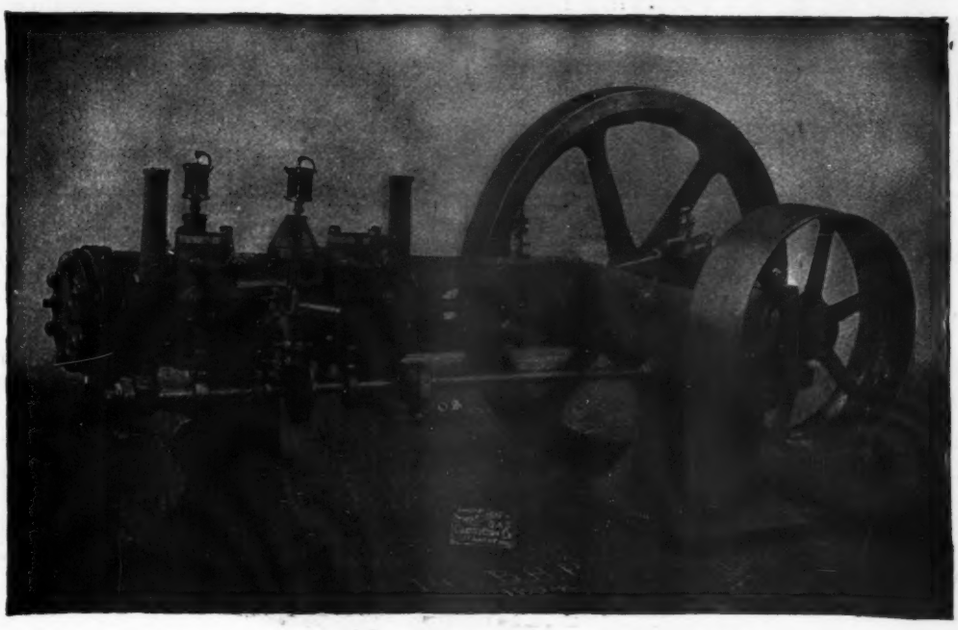

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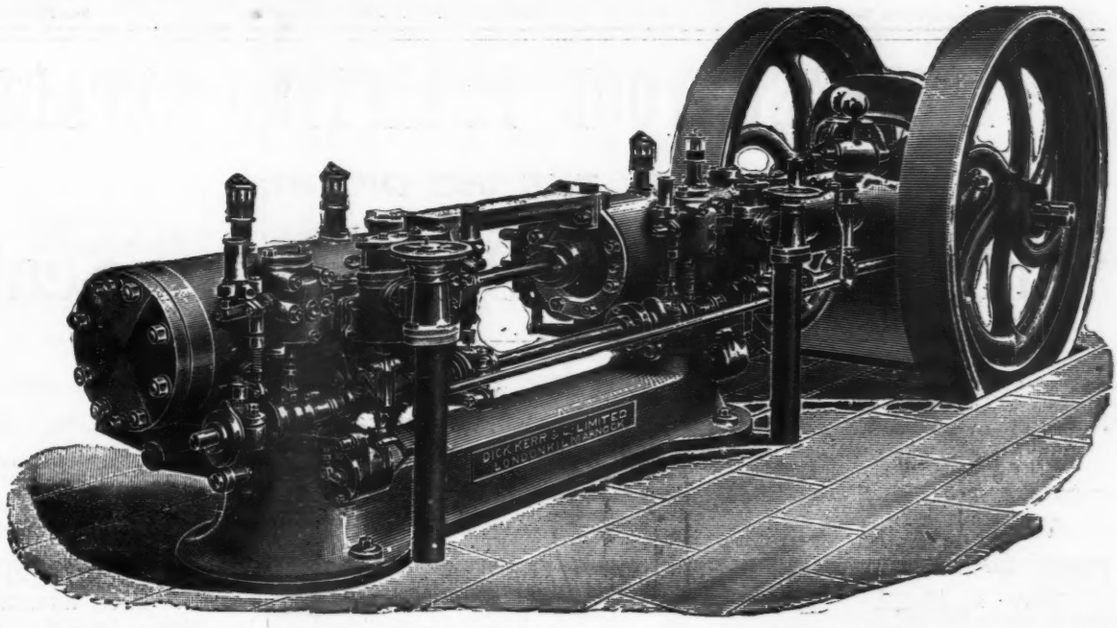

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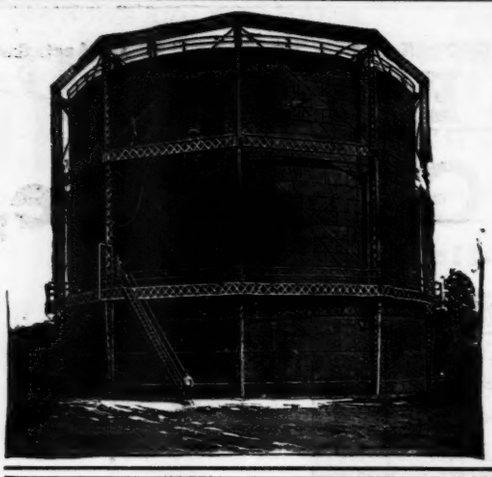

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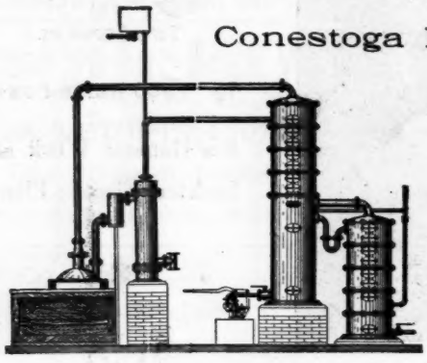

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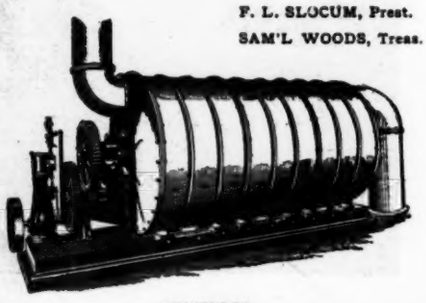

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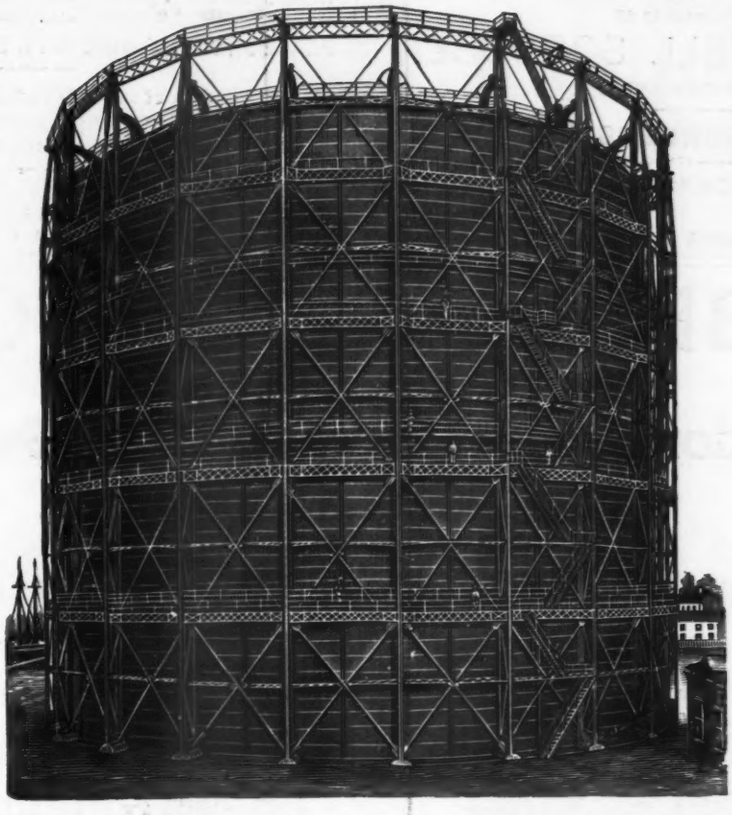

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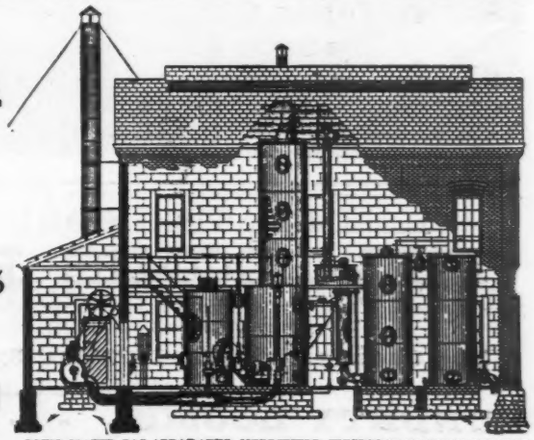

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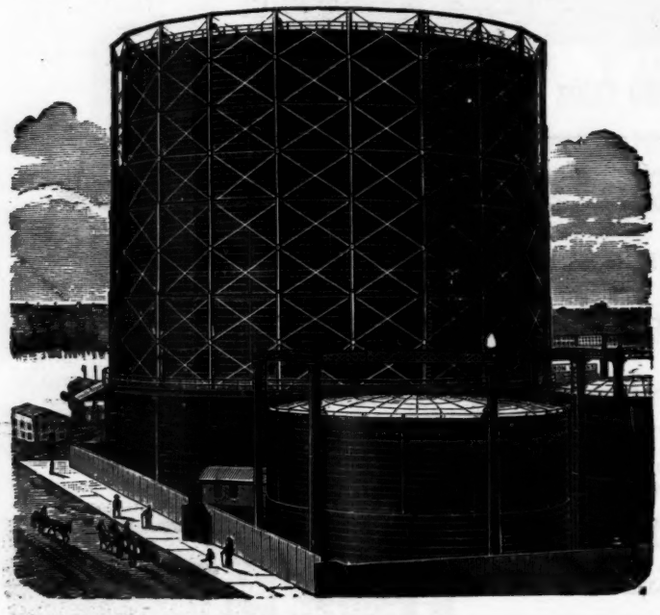

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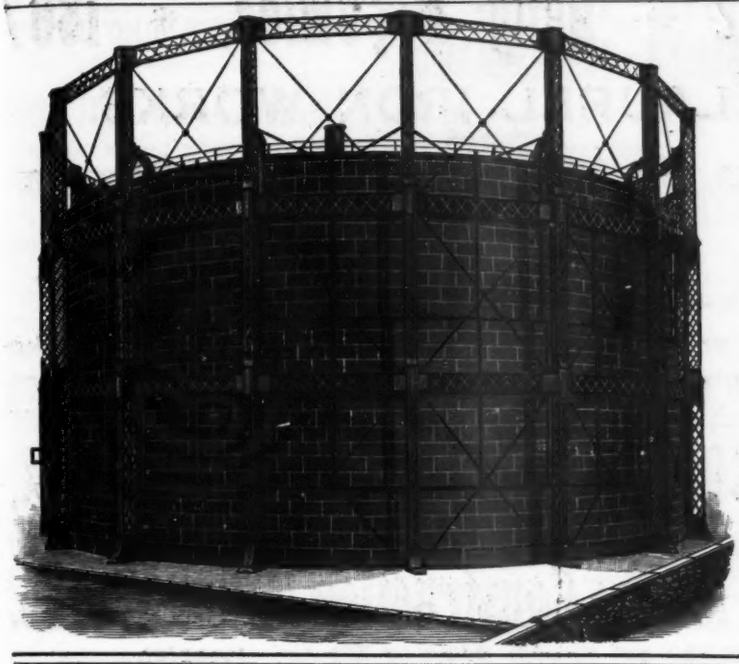

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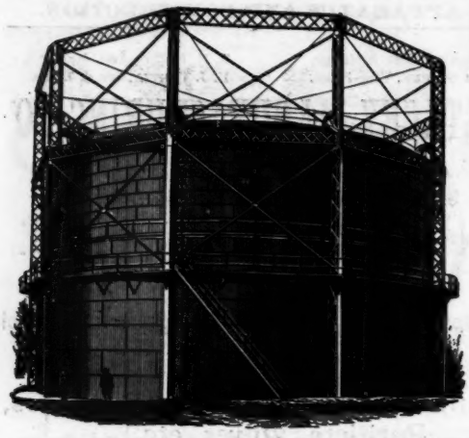

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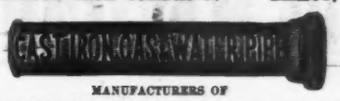

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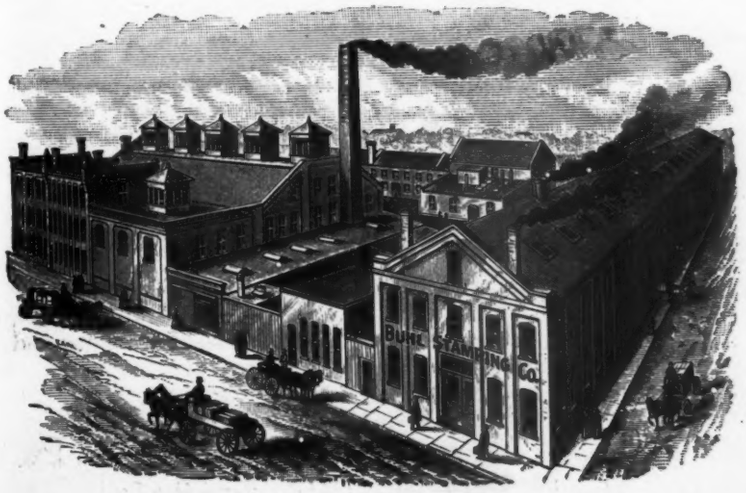

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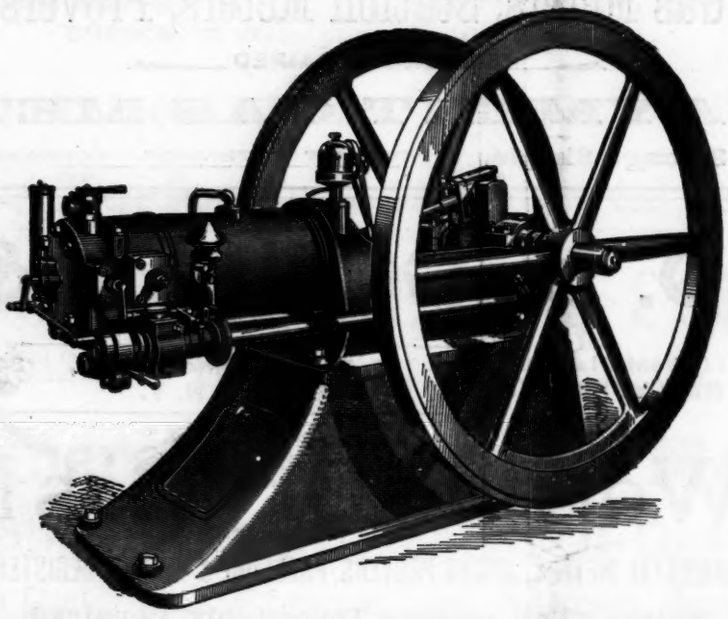

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